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Sauget Area 1, Sauget and Cahokia, Illinois

Dead Creek Sediment Removal Action

Mitigation Plan

May 21, 2002

Submitted To:

U.S. Environmental Protection Agency

Region 5, Chicago, Illinois

Submitted By:

Solutia Inc, St. Louis, Missouri

Figures

Appendices

1.0 Introduction

On August 29, 2001, USEPA Region 5 issued an Amended Administrative Order (Docket No. V-W-99-C-554) for a time-critical sediment removal action in Dead Creek, a 3.5-mile long stream located in Sauget and Cahokia, St. Clair County, Illinois. As required by the Order, approximately 46,000 cubic yards of impacted sediment were removed from Creek Segments B, C, D, E and F, Site M and the lift station sump where Dead Creek discharges into Old Prairie du Pont Creek. Excavated sediments were transferred to a RCRA and TSCA-compliant containment cell constructed adjacent to the west bank of Dead Creek Segment B just north of Judith Lane. Sediment transfer was completed in January 2002. A temporary plastic cover was installed in the cell to isolate the impacted sediments from storm water. Storm water falling on the cell was contained and treated using granular activated carbon prior to discharge to Creek Segment B.

In addition to installing the cap on the containment cell, several additional work elements required by Section 3, Work to be Performed, of the Order need to be completed. Remaining work includes Section 3.B.4 Excavated Area Soil Sampling, Section 3.B.5 Excavated Area Bottom Liner Requirements, and Section 3.C Mitigation Plan. The first two work elements are underway and will be addressed in a separate document; the third work element is dealt with in this submittal.

Specific requirements of Section 3.C of the Order are:

> "Sixty days after completion of the sediment and soils removal activities required by this Order, Respondent shall submit to EPA a Mitigation Plan which contains a detailed statement describing the steps the Respondents have taken and are taking to ensure that the actions required by this Order are implemented in such a way as to avoid and/or minimize adverse impacts to area wetlands and habitat.
>
> Respondents Mitigation Plan shall also provide for the replacement of all habitat and wetlands unavoidably lost in the implementation of the project. Specifically, Respondents Mitigation Plan shall provide an accounting of all wetlands and habitat adversely affected by the project and specific actions Respondents will take, and an associated schedule, to provide replacement of the value and function associated with lost wetlands and habitat.
>
> The Mitigation Plan shall also include a plan for investigating any potential "hot spots" of contamination found in the Borrow Pit Lake located directly west of Creek Segment F. This "hot spot" investigation plan shall also provide for the

remediation of those sediments in the Borrow Pit Lake that are found to be acting as a source to further risk to human health and the environment."

To summarize, the Mitigation Plan requires the following plans or reports:

Implementation Mitigation Plan - A plan to avoid and/or minimize adverse impacts to area wetlands and habitat during implementation of the removal action;

Baseline Habitat Assessment - An accounting of all wetlands and habitat adversely affected by the removal action;

Creek Channel Mitigation Plan - A plan to provide replacement of the value and function associated with lost wetlands and habitat; and

Borrow Pit Lake Investigation and Remediation Plan - A plan to identify and remediate any potential "hot spots" in the Borrow Pit Lake located directly west and downstream of Creek Segment F.

Measures to be taken to avoid and/or minimize adverse impacts to wetlands and habitat during implementation of the removal action were described in the June 30, 2000 Time Critical Removal Action Work Plan, Dead Creek Sediment and Soil, Sauget and Cahokia, Illinois submitted to USEPA Region 5 by Solutia Inc. A brief summary of these actions is given below:

Creek Segment B - "Trees growing within the creek channel and branches hanging over the channel that might interfere with equipment operation will be chipped and incorporated in the impacted sediment. Most the CS-B channel is clear of trees except for the north end immediately south of Queeny Avenue. These trees will need to be removed in order to conduct the sediment removal action. The east bank of CS-B is lined with trees from Queeny Avenue south to the north side of Site M. These trees will not be removed as part of the sediment removal action. Only branches hanging over the creek will be cut and chipped if they can interfere with the safe and efficient implementation of the sediment removal action."

Creek Segment C - "While trees line a good portion of the creek banks of CS-C, the creek channel is clear of trees. Consequently, tree removal will not be necessary except where branches overhanging the channel might interfere with equipment operation. Such branches will be removed, chipped and incorporated in the impacted sediment."

Creek Segment D - "While trees line a good portion of the creek banks of CS-D, the creek channel is clear of trees. Consequently, tree removal will not be necessary except where branches overhanging the channel might interfere with equipment operation. Such branches will be removed, chipped and incorporated in the impacted sediment."

Creek Segment E - "While trees line most of the east creek banks [of CS-E between Jerome Lane and Edgar Street], the creek channel is clear of trees. Consequently, tree removal will not be necessary except where branches overhanging the channel might interfere with equipment

operation. Such branches will be removed, chipped and incorporated in the impacted sediment. ... Trees line both banks of the creek [in the stretch of Creek Segment E between Edgar Street and the second of the three streets in the Quail Run trailer park], however, the channel is clear of trees. Consequently, tree removal will not be necessary except where branches overhanging the channel might interfere with equipment operation. Such branches will be removed, chipped and incorporated in the impacted sediment. ... In the stretch of Dead Creek between the second street in the Quail Run trailer park and the north end of the Parks College parking lot, one to six-inch diameter trees are growing in the channel bottom and line both banks of the channel. These trees will need to be removed in order to excavate impacted sediments. Care will be taken to remove no more trees than necessary to excavate sediments in a safe and responsible manner. ... Small diameter trees are also growing in the CS-E channel from the south end of the Parks College parking lot to Route 157. These trees will be chipped and incorporated in the impacted sediment. Care will be taken to remove no more trees than necessary to excavate sediments in a safe and responsible manner. Large trees are growing on the banks in this stretch of the creek. Branches overhanging the channel that might interfere with equipment operation will be chipped and incorporated in the impacted sediment."

With two exceptions, the sediment removal action was performed as described above to minimize impact on habitat adjacent to the creek. One exception to the planwas removal of the trees along the east bank of Creek Segment B in order to provide access to implement the removal action. The other exception was using chipped trees as mulch in the areas adjacent to the creek rather than incorporating them into the impacted sediments. This increased the volume available for impacted sediments in the containment cell and improved the moisture-holding capacity of the soils adjacent to the creek.

The Baseline Habitat Assessment, Creek Channel Mitigation Plan and Borrow Pit Lake Investigation and Remediation Plan are discussed in Sections 2.0, 3.0 and 4.0 of this document, respectively

2.0 Baseline Habitat Assessment

In November 2000, prior to the start of sediment removal, Woodlot Alternatives, Inc. performed a baseline habitat assessment for Creek Segments B, C, D and E and Creek Segment F upstream of the Terminal Railroad Embankment. During this assessment, qualitative and quantitative information on plants, animals, vegetation alliances and hydrologic regimes was collected to identify organisms potentially at risk from the removal action and provide the information needed to develop habitat restoration plans.

Dead Creek and adjacent riparian communities form a narrow, linear wetland system that passes through Sauget and Cahokia, Illinois. Portions of Dead Creek are adjacent to residential and business lots that contain mowed lawns, buildings, driveways and roads. To a great extent, these areas are so modified that only relict portions of natural vegetation alliances exist. Furthermore, many areas are also influenced by non-native plant species. However, sections of the creek are utilized by rare species indicating that Dead Creek does posses value for wildlife habitat and as a travel corridor.

Vegetation alliances were identified during field surveys performed on November 2, 8, 9, 10 and 11, 2000 and were mapped to determine the areal extent of each alliance. Quantitative and qualitative data regarding plant species abundance and distribution were collected for all dominant vegetation communities. Quantitative data on plant species composition and abundance were collected in 9m radius plots for trees, lianas, saplings, shrubs, seedlings and herbs. Qualitative data collected outside of the plots included photographs of each community, a list of all plant species observed and general descriptions of the degree of anthropogenic disturbance and estimated age of forested communities.

Nine vegetation alliances were identified in Dead Creek:

- Fraxinus americana - Ulmus americana Temporarily Flooded Forest
- Populus deltoides Temporarily Flooded Forest
- Salix nigra Temporarily Flooded Forest
- Cephalanthus occidentalis Semi-Permanently Flooded Shrubland
- Persicaria - Mixed Forb Temporarily Flooded Herbaceous
- Typha Seasonally Flooded Herbaceous
- Potamogeton - Ceratophyllum - Elodea Permanently Flooded Herbaceous

- Temporarily Open Water
- Permanent Open Water

Dead Creek is occupied to a significant extent by non-native, invasive plant species. Though exotic herbaceous species are present, it is the introduced and escaped woody species found in the forested communities that are most prevalent. White mulberry, Siberian elm, paper mulberry and tree-of-heaven are frequent throughout the study area and, in some cases, locally dominant. Common, non-native lianas, including trumpet-creeper, Japanese honeysuckle and Chinese spindle-tree, were frequently seen growing as a dense mat over the ground or other woody species. Amur honeysuckle is the common, non-native shrub in the study area.

Qualitative information on animal use was collected through direct observation of species or their sign, by a review of previous site investigations and by comparing habitat available on site to habitat requirements of species known or suspected to occur in or near the project area. Information on aquatic invertebrates and fish was obtained from previous investigations and dip nets surveys performed during the Baseline Habitat Assessment. Amphibians, reptiles, birds and mammals seen on the site were recorded.

Animal use is generally limited to species that do not require large tracts of pristine land and can tolerate come level of habitat modification and disturbance. Several species of birds were observed including American robin, northern cardinal, blue jay, northern mockingbird, Carolina wren, sparrows, Eurasian tree sparrow, European starlings, waterfowl, wading birds and great horned owl. Mammals using Dead Creek include eastern chipmunks, gray squirrels, raccoons and white-tailed deer.

Rare species observed in the Dead Creek include one state threatened species of bird, Brown Creeper (Serthia americana), and one potentially rare grass, Early Wild-rye (Elymus macregorii).

A qualitative wetland function-value assessment was performed to document existing functions and values in Dead Creek. Results of surveys and community plot sampling along Dead Creek indicate that it is a highly modified wetland system that, for much of the season, appears to act more as a set of shallow ponds rather than a riverine system. Riparian communities portray classic symptoms of residential development, including narrow and fragmented forests, young

canopy trees, limited vertical diversity in terrestrial habitats, bisection by numerous roads, disturbed drainage and a high incidence of non-native species. Dead Creek, nonetheless, plays an important role in the local storm water flow, is a wildlife travel corridor and is utilized by rate and uncommon plant and animal species.

Results of the baseline habitat assessment are presented in Appendix 1.

3.0 Creek Channel Mitigation Plan

A baseline habitat assessment performed by Woodlot Alternatives, Inc. demonstrated: 1) that a variety of alliances or communities were present on site prior to the sediment removal action, 2) they were limited in habitat quality by size and 3) significant non-native species occurred in the project area (Appendix 1). The goal of this revegetation plan is to restore the creek to a more natural, native landscape that can become an effective greenway/wildlife corridor through the middle of this urbanized area. Dead Creek connects with other quality natural areas near the Mississippi River at its downstream end. Therefore, by re-establishing native vegetation and connecting it with other natural areas, Dead Creek has the potential of becoming an effective and beautiful greenway corridor through the local community.

Specifically, the Creek Channel Mitigation Plan is focused on:

- Re-establishing Dead Creek as an amenity to the local community;
- Creating a quality, natural landscape with native, locally appropriate plant species;
- Achieving success by using readily available plant species; and
- Using methods and equipment associated with habitat restoration contractors.

These goals will be achieved by incorporating a variety of native seeds in the upland and channel sections of Dead Creek. Mulch will be installed for erosion control during the establishment period. Incorporated seeds will not include any woody or non-seed species because significant evidence suggests that prior to settlement, many areas in St. Louis, including some streams, were prairie or savanna in community. Additionally, in order to provide the best stabilization of the creek banks, grasses and grass-like plants, as well as a diversity of forbs, are required. Finally, unless maintained in a prairie or savanna like community, it is likely that a variety of tree species may, over time, begin to dominatethe project area without being installed with this project. Therefore, the revegetation plan for Dead Creek is focused on utilizing locally appropriate native seeds.

Seed mixtures selected for this project represent a mix of plant species that are appropriate for native, naturalized areas, and are hardy, yet are not routinely invasive. In addition, they are taken from Illinois Department of Transportation native seed mixes and therefore have been

proven and accepted by numerous Illinois agencies. Local contractors and seed suppliers are familiar with these products.

Two seed mixtures will be used: 1) Low Profile Native Grass and 2) Wetland Grass and Sedge Mixture. The Low Profile Native Grass Seed mix will include Little Blue Stem, Side-Oats Grama, Wild Rye, Prairie Drop Seed, Annual Ryegrass, Spring Oats and Perennial Ryegrass. The Wetland Grass and Sedge Mixture will include Annual Ryegrass, Spring Oats, Blue Joint Grass, Lake-Bank Sedge, Awl-Fruited Sedge, Tussock Sedge, Fox Sedge, Needle Spike Rush, Blunt Spike Rush, Fowl Manna Grass, Common Rush, Slender Rush, Torrey's Rush, Rice Cut Grass, Hard-Stemmed Bullrush, Dark Green Bullrush, River Bullrush, Softstem Bullrush and Prairie Cord Grass.

Specifications for seeding and mulching are included in Appendix 2 and 3, respectively. These specifications will require any potential contractor to perform the work in a manner consistent with native vegetation restoration, but also provide that contractor some latitude in how they accomplish this work. Therefore, a number of methods and techniques were identified that should provide the best establishment success.

Additionally, while the seed is germinating and beginning root and stem growth during the establishment period, mulch will maintain the seed in place and minimize erosion to the site. The mulching specifications were not "engineered" per se, but do set out requirements for meeting specific environmental conditions. The specifications note that manufacturer recommendations should be met and the local mulching materials supplier may become actively involved in the project as a result.

Figures 3 - 1 through 3 - 17 show the planned location of the two seed mixes.

4.0 Borrow Pit Lake Investigation and Mitigation Plan

During performance of the Sauget Area 1 Ecological Risk Assessment, mercury was identified as a constituent causing a potentially unacceptable impact to forage fish in the Borrow Pit Lake (BPL) and birds (Great Blue Heron) feeding on the forage fish. Only one of three forage fish samples from the Borrow Pit Lake had mercury concentrations above a threshold level thought to be harmful to fish, indicating that mercury was not widely distributed throughout the BPL. Other information on mercury in the Dead Creek watershed and reference areas sampled as part of the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan indicate that mercury is not wide spread. For example, three sediment samples were collected in the BPL during implementation of the Support Sampling Plan (SSP). Mercury concentrations were 0.091 mg/kg 900 feet south of the north end of the BPL, 0.11 mg/kg 200 feet north of the confluence of Dead Creek and the BPL and 0.16 mg/kg 200 feet south of the confluence. Sediment samples were also collected in two reference areas outside of the Dead Creek watershed. Mercury concentrations in the two samples from Reference Area 1 were 0.042 and 0.063 mg/kg while concentrations in the two samples from Reference Area 2 were 0.04 and 0.048 mg/kg.

Mercury analytical data is also available for sediment samples collected in Dead Creek as part of the SSP. These results are summarized below by creek segment with the upstream sample in each segment listed first:

Creek Segment	Sample 1	Sample 2	Sample 3
CS-B	1.4	1.5	0.96
CS-C	0.58	0.64	0.66
CS-D	0.35	0.42	0.5
CS-E	0.3	0.3	0.51
CS-F	0.45	1.1	0.3

Note: Concentrations are in mg/kg

None of these data indicate that a mercury hot spot is present in Dead Creek sediments or in Borrow Pit Lake sediments.

Since all sediments were removed from the Dead Creek channel during the sediment removal action, they are no longer a potential source for the mercury found in one of the three forage fish samples collected in the BPL. To determine if there are mercury "hot spots" in the Borrow Pit

Lake, sediment samples will be collected as described below in Section 4.1 Borrow Pit Lake Investigation Plan.

4.1 Borrow Pit Lake Investigation Plan

Sampling Program Rationale and Design - Vertically integrated sediment core samples will be collected from Borrow Pit Lake on a 200 ft grid in order to evaluate the distribution of mercury in sediments immediately upstream, at and downstream of the confluence of Dead Creek with the BPL. Data collected during the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan show no evidence of backwater deposition of the organic constituents in the BPL upstream of its confluence with Dead Creek and limited evidence of inorganic constituent deposition:

Constituent	Creek Segment F	BPL Upstream of Confluence	BPL Downstream of Confluence
PCBs	ND to 6,290 ppb	ND	ND to 10 ppb
Copper	39 to 5,400 ppm	9.9 to 21 ppm	10 to 88 ppm
Zinc	510 to 11,000 ppm	230 to 490 ppm	50 to 680 ppm

Concentrations of all of these Sauget Area 1 site-related constituents are lower in the portion of the BPL upstream of its confluence with Dead Creek than the concentrations in Dead Creek Segment F or in the BPL downstream of the confluence. These data demonstrate that backwater deposition of site-related constituents is not occurring in the BPL upstream of its confluence with Dead Creek. Consequently, the mercury "hot spot" sampling program is focused on the confluence of Dead Creek with the BPL and areas downstream of the confluence.

Samples will be collected from the center of each grid cell, resulting in approximately 37 locations (Figure 4 - 1).

Number of Sediment Samples: 37

Analysis: Mercury USEPA Method 7471

Severn Trent Laboratories in Savannah Georgia (STL-Savannah) will perform the sediment analyses. Sampling locations will be finalized in the field with the concurrence of USEPA Region V or its designee. Sampling methods, procedures and protocols will be the same used for the Sauget Area 1 EE/CA and RI/FS Support Sampling Plan and associated Field Sampling Plans and Quality Assurance Project Plans.

QA/QC Samples - QA/QC samples will consist of one duplicate per ten, or fraction of ten, environmental samples collected and one MS/MSD or spike duplicate per twenty, or fraction of twenty, environmental samples collected. Duplicate, MS/MSD, and spike duplicate samples will be submitted for analysis. Duplicate samples are collected to measure consistency of field sampling technique. MS/MSD and spike duplicate samples are collected to measure laboratory quality control procedures. A field blank (or equipment blank) must be submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples. The minimum required is one per ten, or fraction of ten, environmental samples collected, unless dedicated or disposable sampling equipment is used to collect the samples.

Field Procedures - Coordinates for each sampling location will be established from existing topographic surveys prior to undertaking the sampling effort. This will be accomplished by overlaying a 200 ft by 200 ft grid pattern over the Borrow Pit Lake on the site topographic map. A GPS unit will be used in the field to navigate to each sampling location based on these pre-established coordinates.

Sediment samples will be collected using a manual push-type sediment core sampler. The sampler consists of a PVC barrel, polycarbonate (Lexan®) liner, check valve, extension rods, and a "T" handle. A liner will be placed into the bottom of the tube and secured in place. The sampler will then be pushed into the sediment, collecting a sediment sample from 0 to 18 inches below the top of the sediment. Sediment will then be pulled up, creating a slight vacuum that closes the check valve. The tube will be removed from the sampler, and the sediment will be placed into the sample containers. Where water depths require, extensions will be added to the sample tube to facilitate collecting the sediment sample. In these instances, a boat will be used to reach the sampling location. Sample containers will be placed on ice in coolers. Chain-of-custody procedures will be followed. After each sampling location or when all decontaminated

sampling equipment has been used, sampling equipment will be decontaminated according to the procedures outlined below.

Decontamination - The following procedures will be used for sampling equipment decontamination:

- Brush-wash reusable equipment in a bucket or tub using a trisodium phosphate (TSP) or other commercial detergent solution (2 lb of TSP per 10 gal of clean water). Completely brush the entire exterior surface of the article undergoing decontamination. Wash interior wetted surfaces as required. Rinse the item with copious quantities of potable water, followed by a distilled water rinse.
- Rinse reusable sampling equipment used to collect environmental media for metals analysis in a dilute nitric acid solution, followed by a distilled water rinse.
- Air-dry sampling equipment on a clean, non-plastic surface in a well-ventilated, uncontaminated environment. If the sampling device is not to be used immediately, wrap it in aluminum foil and place it in a plastic bag or storage container.
- Contain rinse water in a plastic tub with a lid. Empty the contents of this tub daily into a 55 gallon drum located at the IDW storage area.

Documentation - A field notebook will be kept for the sediment sampling activity. At a minimum, the field notebook will include the project name and number, date and time, weather conditions, sampler's name, sample location, limiting field conditions, problems encountered, subcontractor personnel on-site, USEPA Region 5 personnel on-site, and other personnel on-site. Notation of USEPA Region 5 acceptance of sampling locations will be included in the field notebook.

4.2 Borrow Pit Lake Remediation Plan

After completion of the Borrow Pit Lake Investigation Plan, validated analytical data will be used to evaluate the potential risks due to mercury in the BPL sediments. As discussed above, only one of three forage fish samples exhibited a concentration above a threshold reported to be toxic to fish. No toxic effects on the forage fish were observed during sample collection. In addition, mercury concentrations in fish from the BPL were within the range found in fish

collected in the Illinois portion of the Mississippi River watershed. Another point to consider is that food chain modeling indicated mercury concentrations for the Great Blue Heron would exceed the No Observed Effects Level but not concentrations known to be toxic to birds. With 37 data points, it should be possible to perform a focused ecological risk assessment for mercury and establish a site-specific clean up level if unacceptable risks are observed.

Figures

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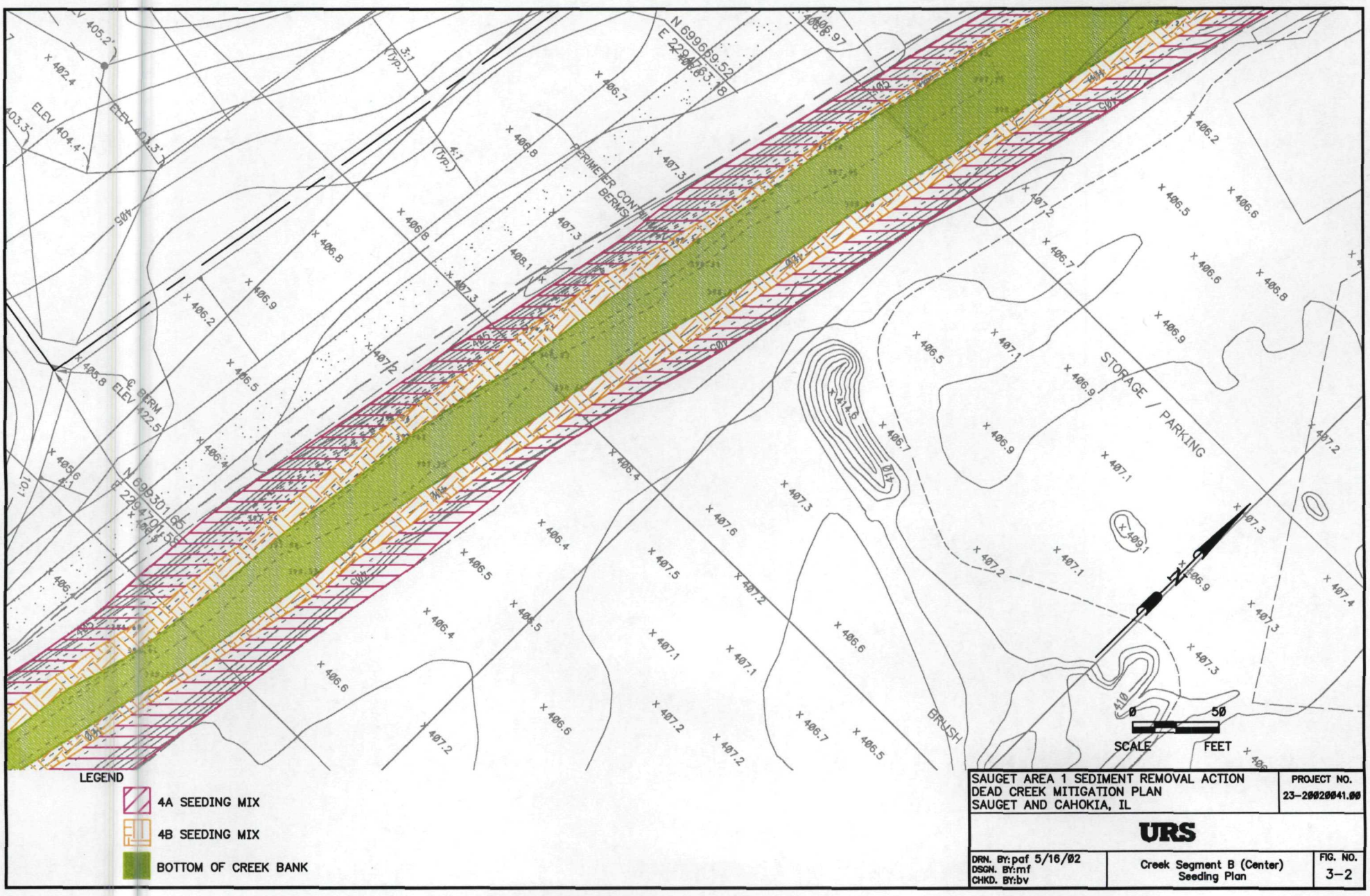

SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-20020041.00

URS

DRN. BY: paf 5/16/02
DSGN. BY: mf
CHKD. BY: bv

Creek Segment B (Center)
Seeding Plan

FIG. NO. 3-2

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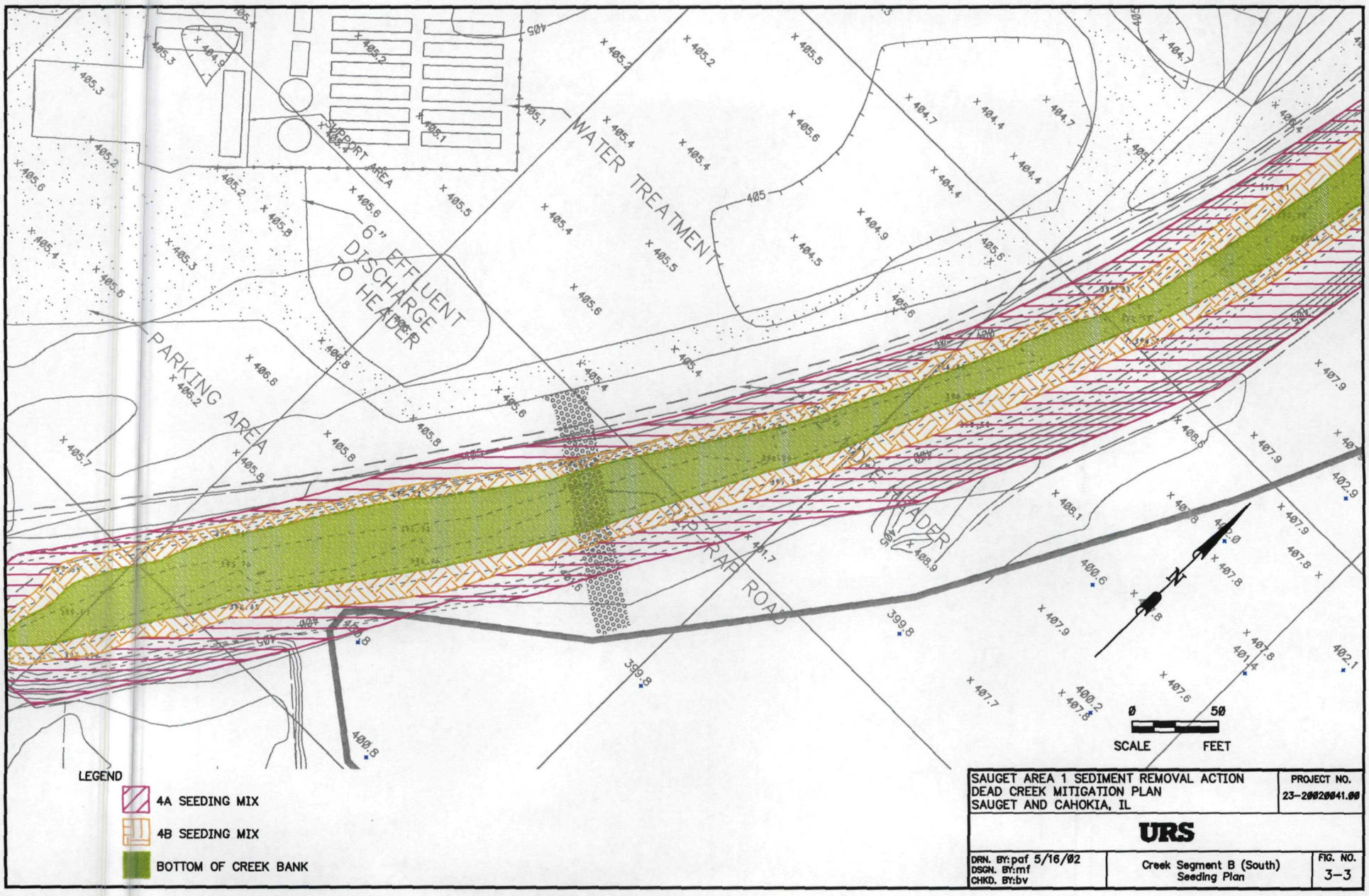

LEGEND

- 4A SEEDING MIX
- 4B SEEDING MIX
- BOTTOM OF CREEK BANK

SAUGET AREA 1 SEDIMENT REMOVAL ACTION DEAD CREEK MITIGATION PLAN SAUGET AND CAHOKIA, IL		PROJECT NO. 23-20020041.00
URS		
DRN. BY: paf 5/16/02 DSGN. BY: mf CHKD. BY: bv	Creek Segment B (South) Seeding Plan	FIG. NO. 3-3

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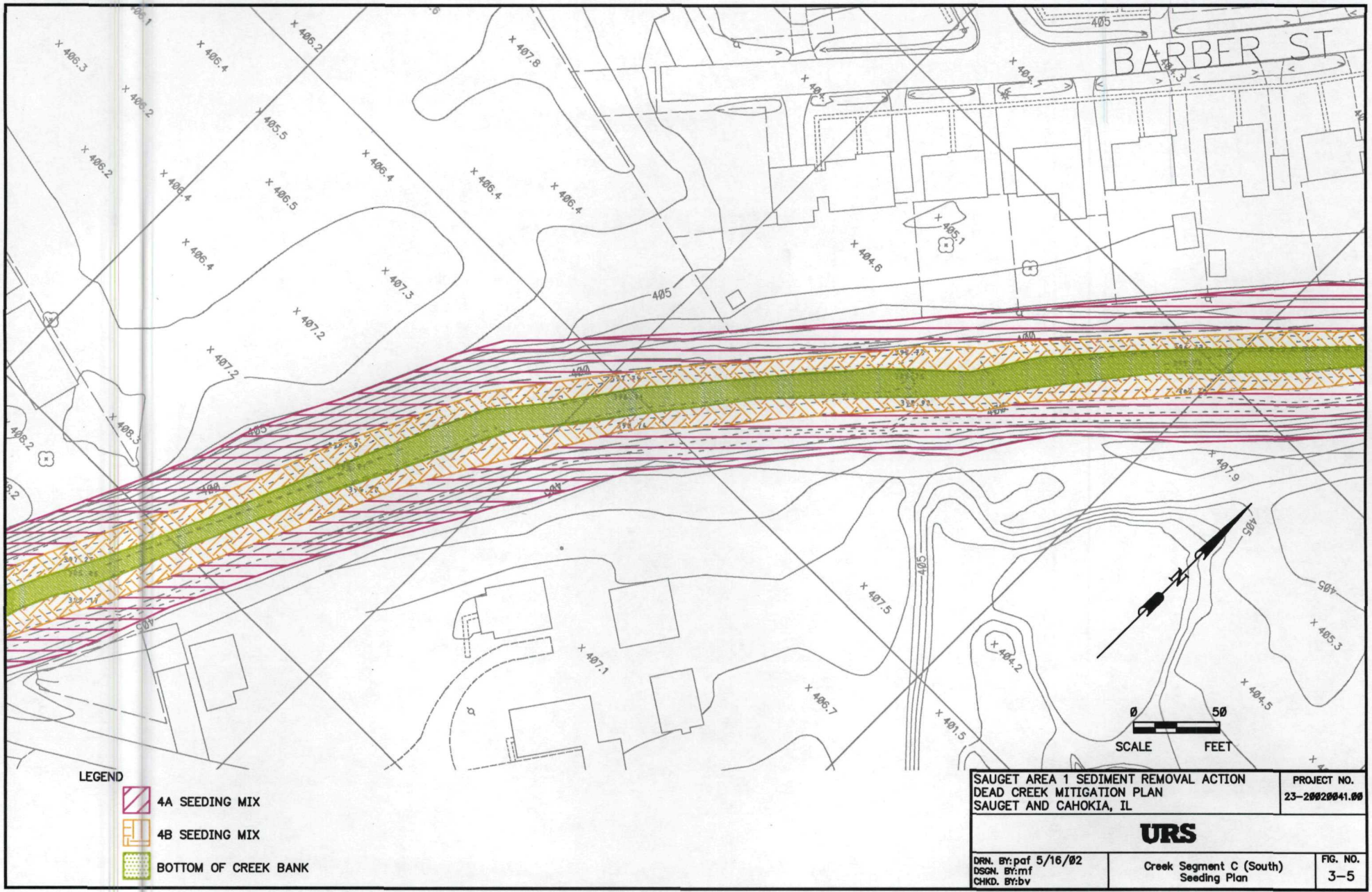
SAUGET AREA 1 SEDIMENT REMOVAL ACTION DEAD CREEK MITIGATION PLAN SAUGET AND CAHOKIA, IL	PROJECT NO. 23-20020041.00
URS	
DRN. BY: paf 5/16/02 DSGN. BY: mf CHKD. BY: bv	Creek Segment C (North) Seeding Plan
	FIG. NO. 3-4



SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-2002041.00

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Creek Segment C (South)
Seeding Plan

FIG. NO. 3-5

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SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-20020041.00

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Creek Segment D
Seeding Plan

FIG. NO. 3-6

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SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-2002@941.@@

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Creek Segment E
(Jerome Lane to Edgar Street)
Seeding Plan

FIG. NO. 3-7

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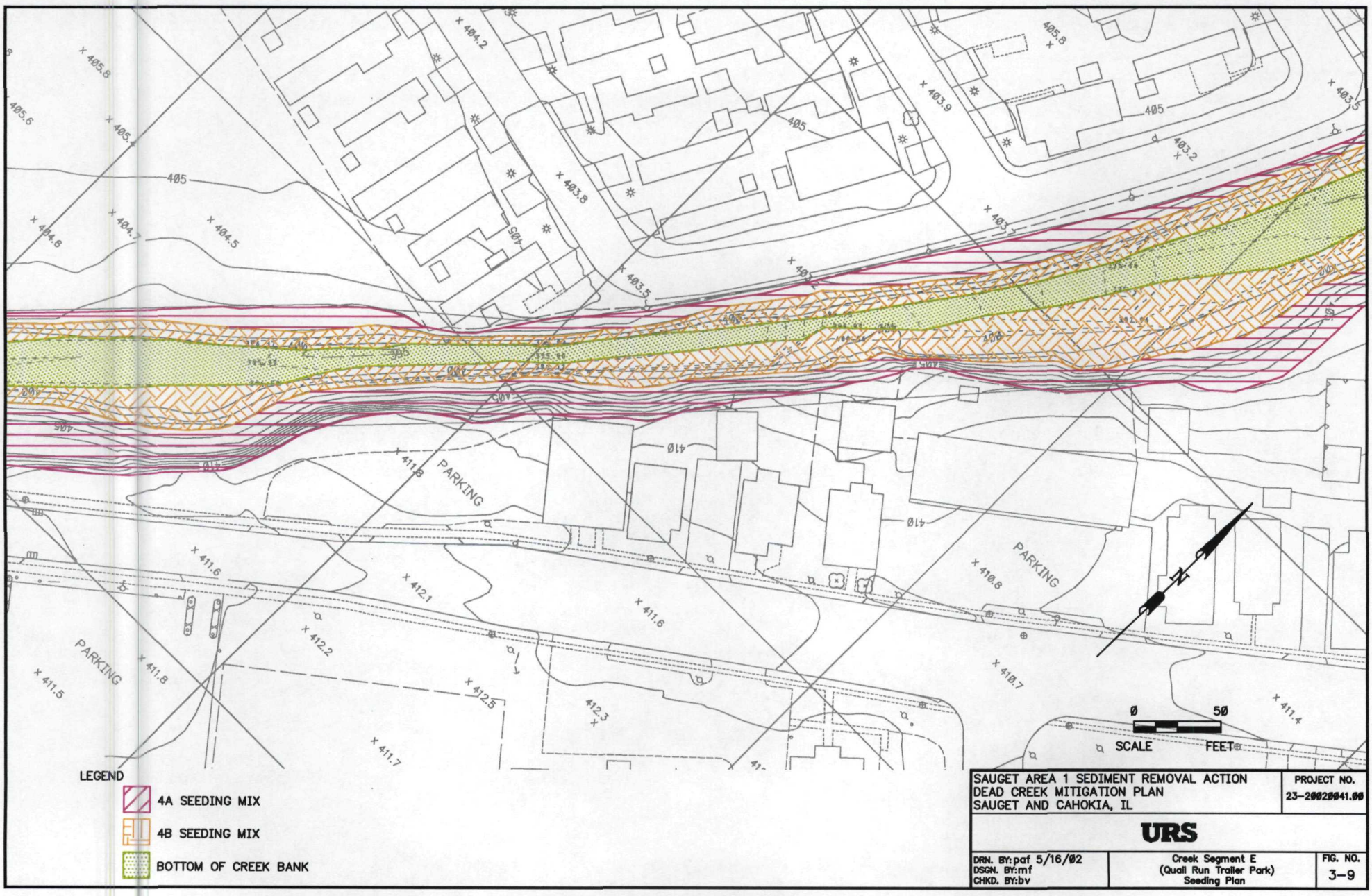

SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-2002041.00

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Creek Segment E
(Quail Run Trailer Park)
Seeding Plan

FIG. NO. 3-9

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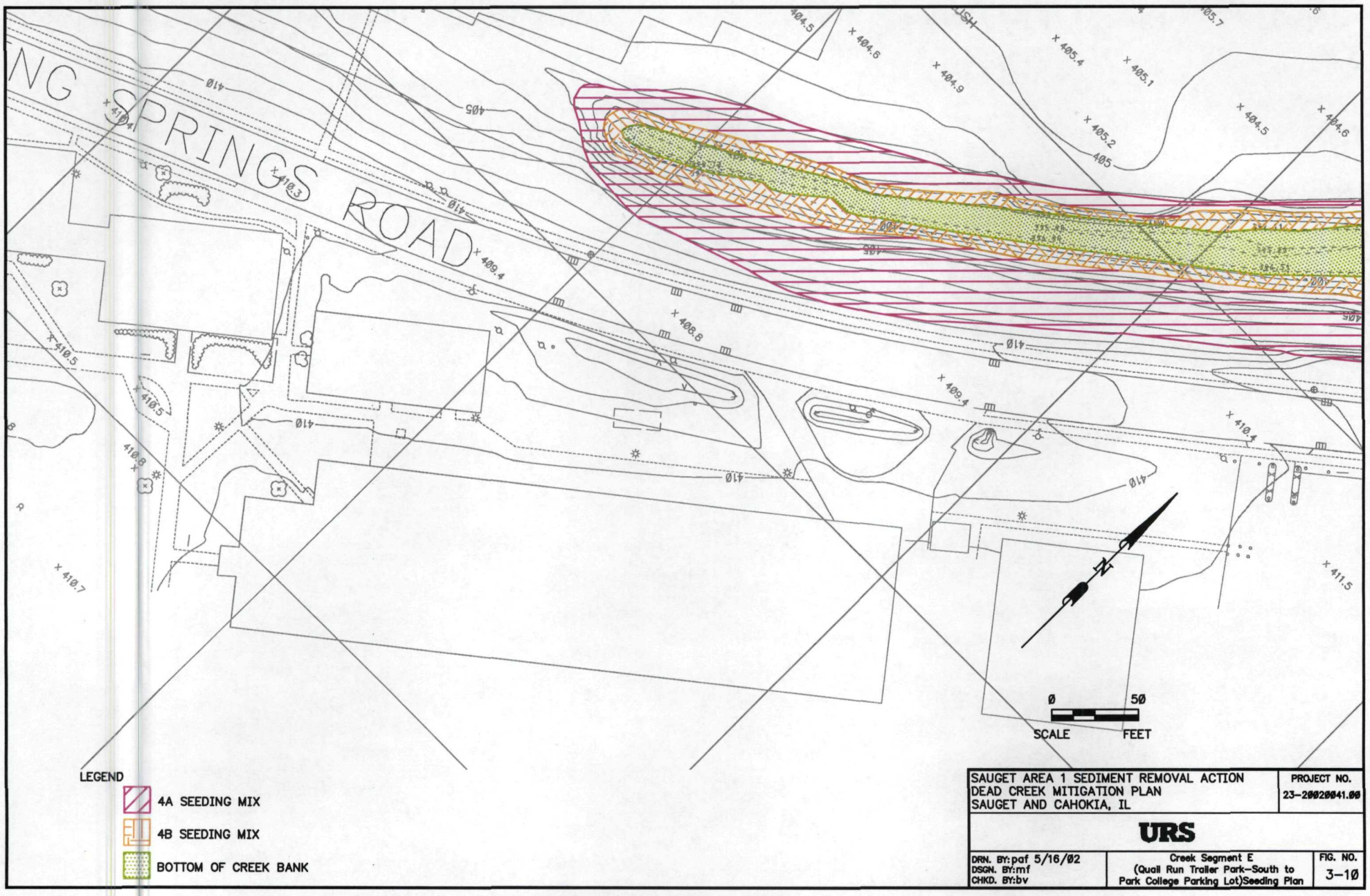

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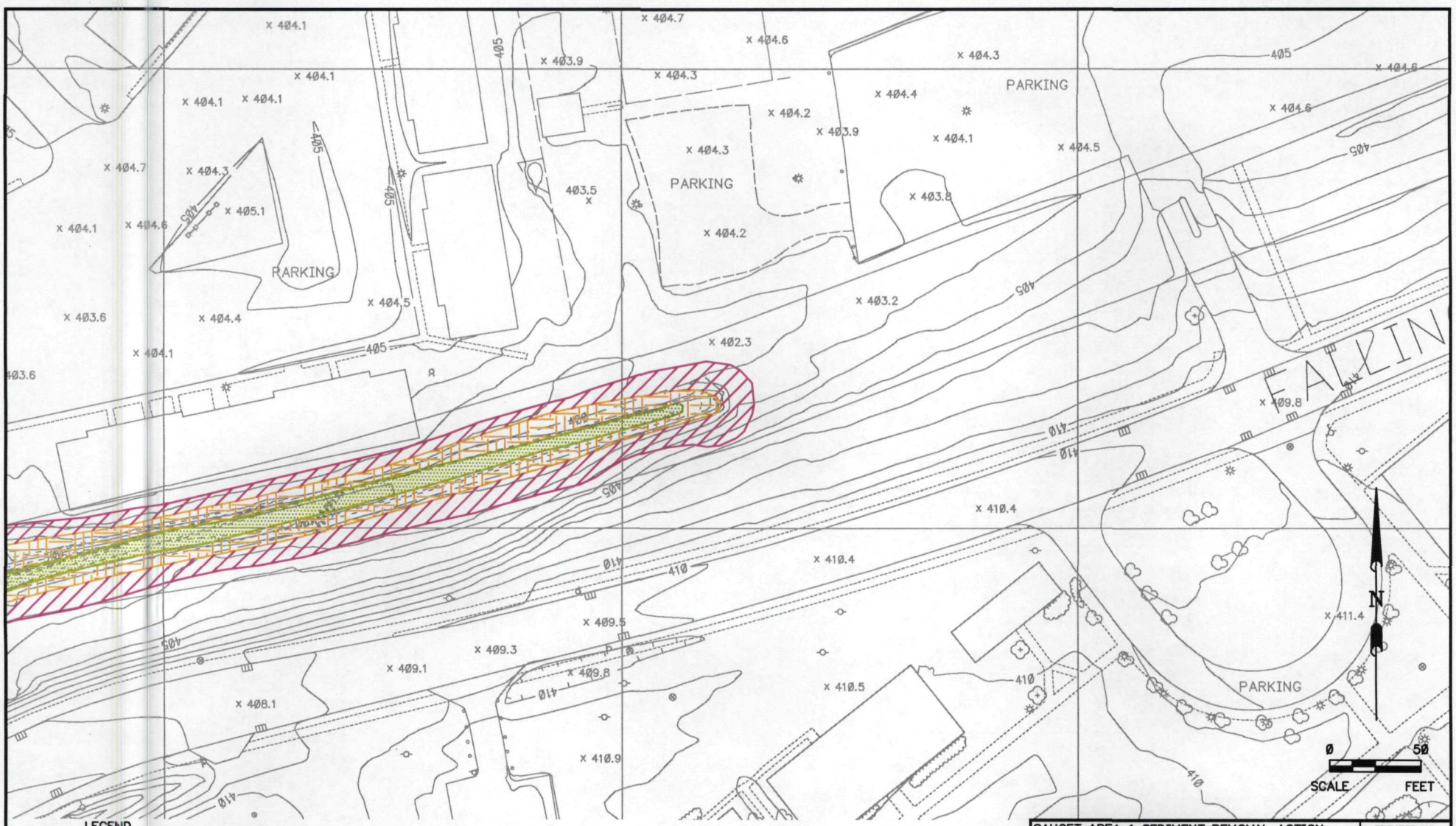

SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO.
23-2002ØØ41.ØØ

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DRN. BY: paf 5/16/Ø2
DSGN. BY: mf
CHKD. BY: bv

Creek Segment E
(Parks College Parking Lot to Cottonwood Apartment) Seeding Plan

FIG. NO.
3-11

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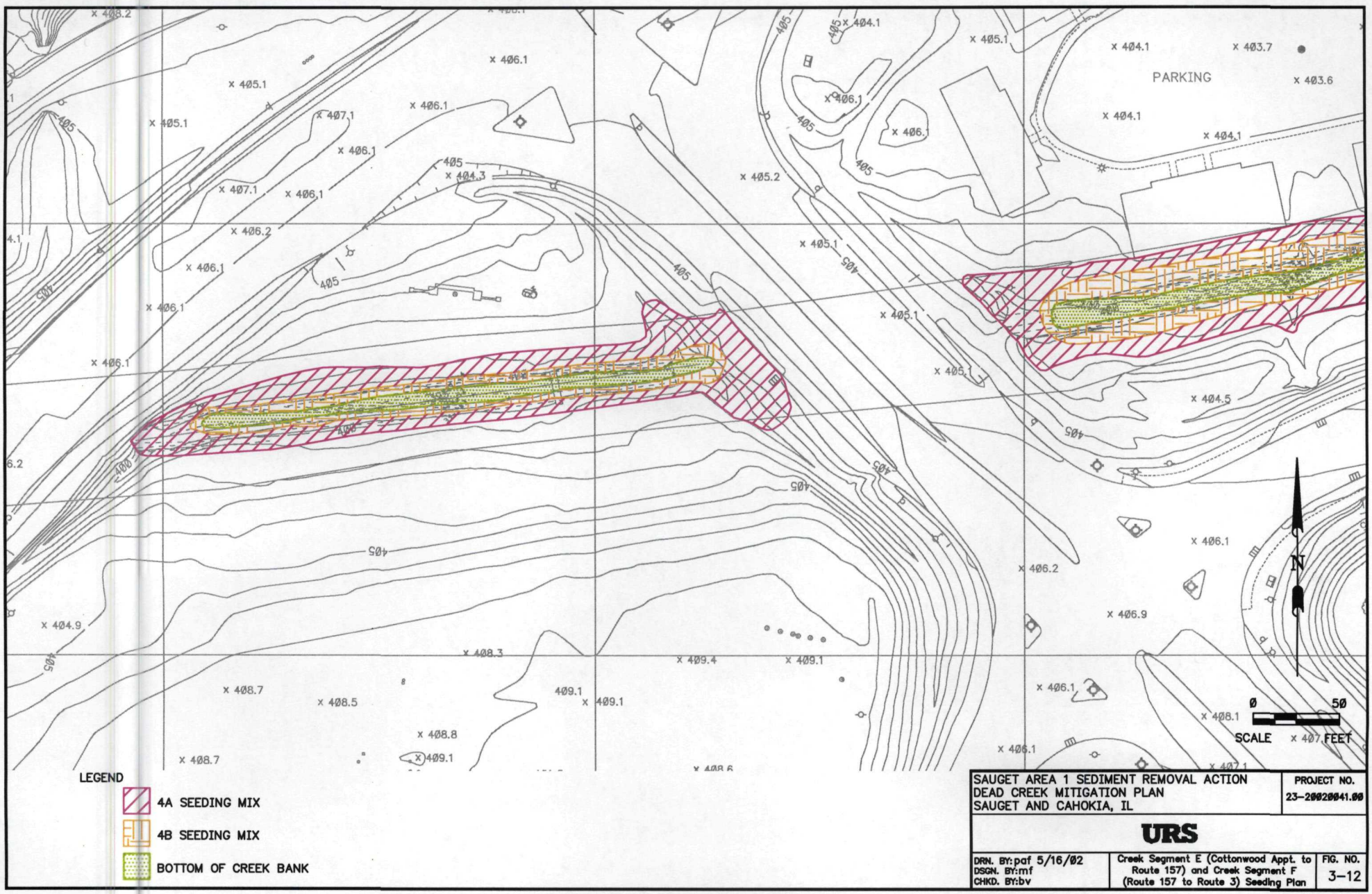

SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-28020041.00

URS

DRN. BY: paf 5/16/02
DSGN. BY: mf
CHKD. BY: bv

Creek Segment E (Cottonwood Appt. to Route 157) and Creek Segment F (Route 157 to Route 3) Seeding Plan

FIG. NO. 3-12

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SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-20020041.00

URS

DRN. BY: paf 5/16/02
DSGN. BY: mf
CHKD. BY: bv

Creek Segment F
(Route 3 to Cargill Road)
Seeding Plan

FIG. NO. 3-13

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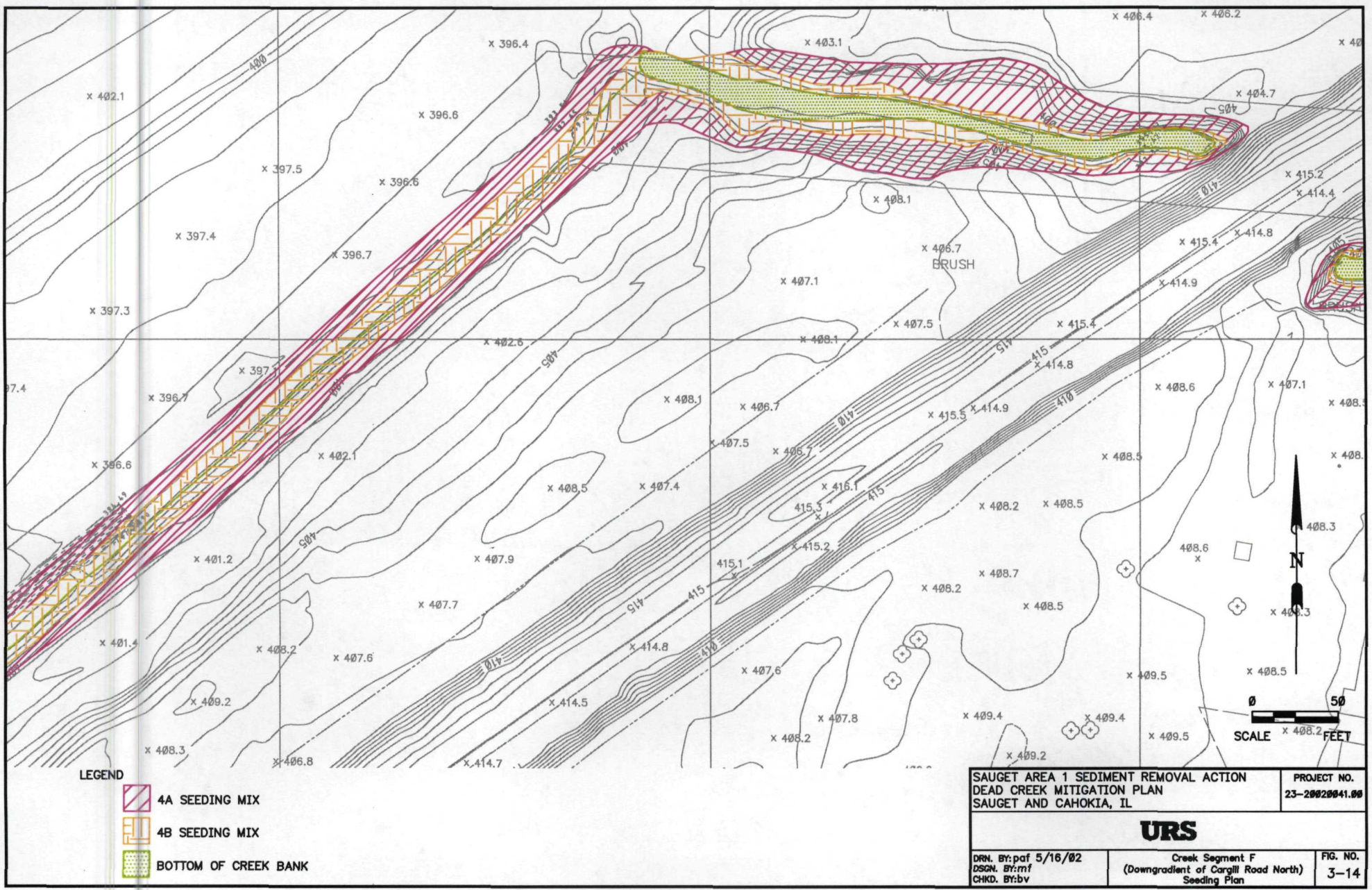

SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-2002Ø041.ØØ

URS

DRN. BY: paf 5/16/Ø2
DSGN. BY: mf
CHKD. BY: bv

Creek Segment F
(Downgradient of Cargill Road North)
Seeding Plan

FIG. NO. 3-14

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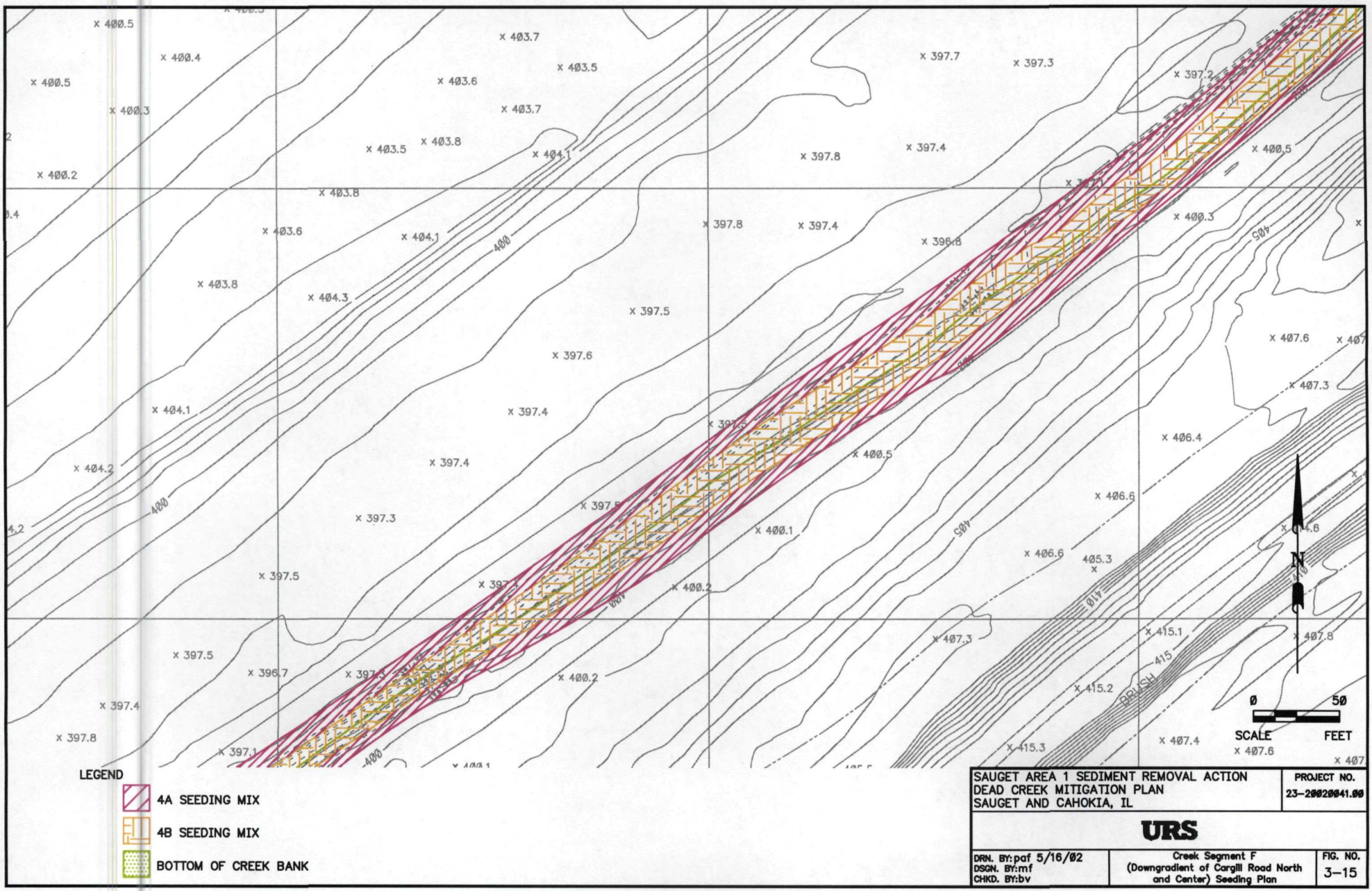

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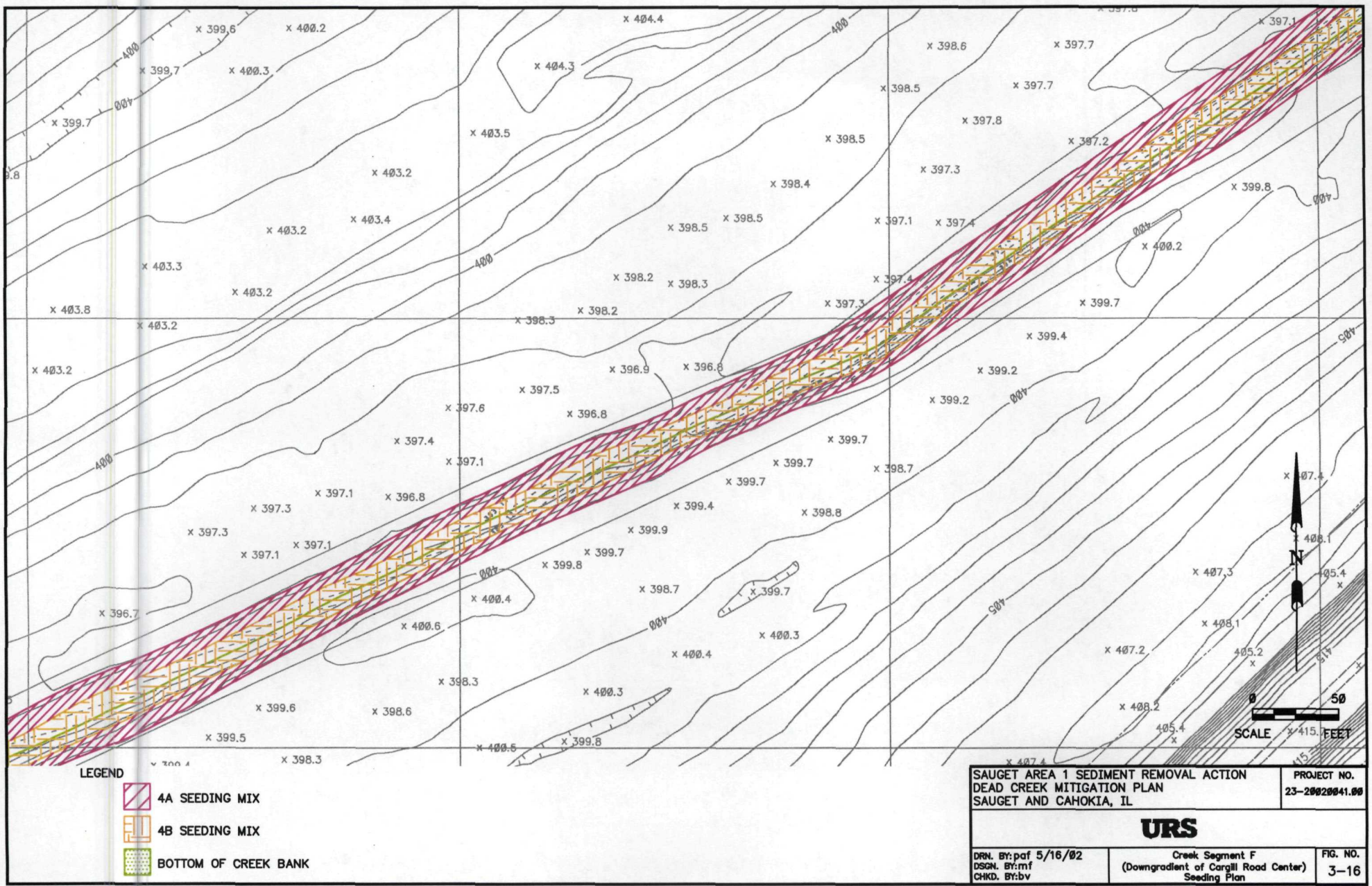

SAUGET AREA 1 SEDIMENT REMOVAL ACTION
DEAD CREEK MITIGATION PLAN
SAUGET AND CAHOKIA, IL

PROJECT NO. 23-20020041.00

URS

DRN. BY: paf 5/16/02
DSGN. BY: mf
CHKD. BY: bv

Creek Segment F
(Downgradient of Cargill Road Center)
Seeding Plan

FIG. NO. 3-16

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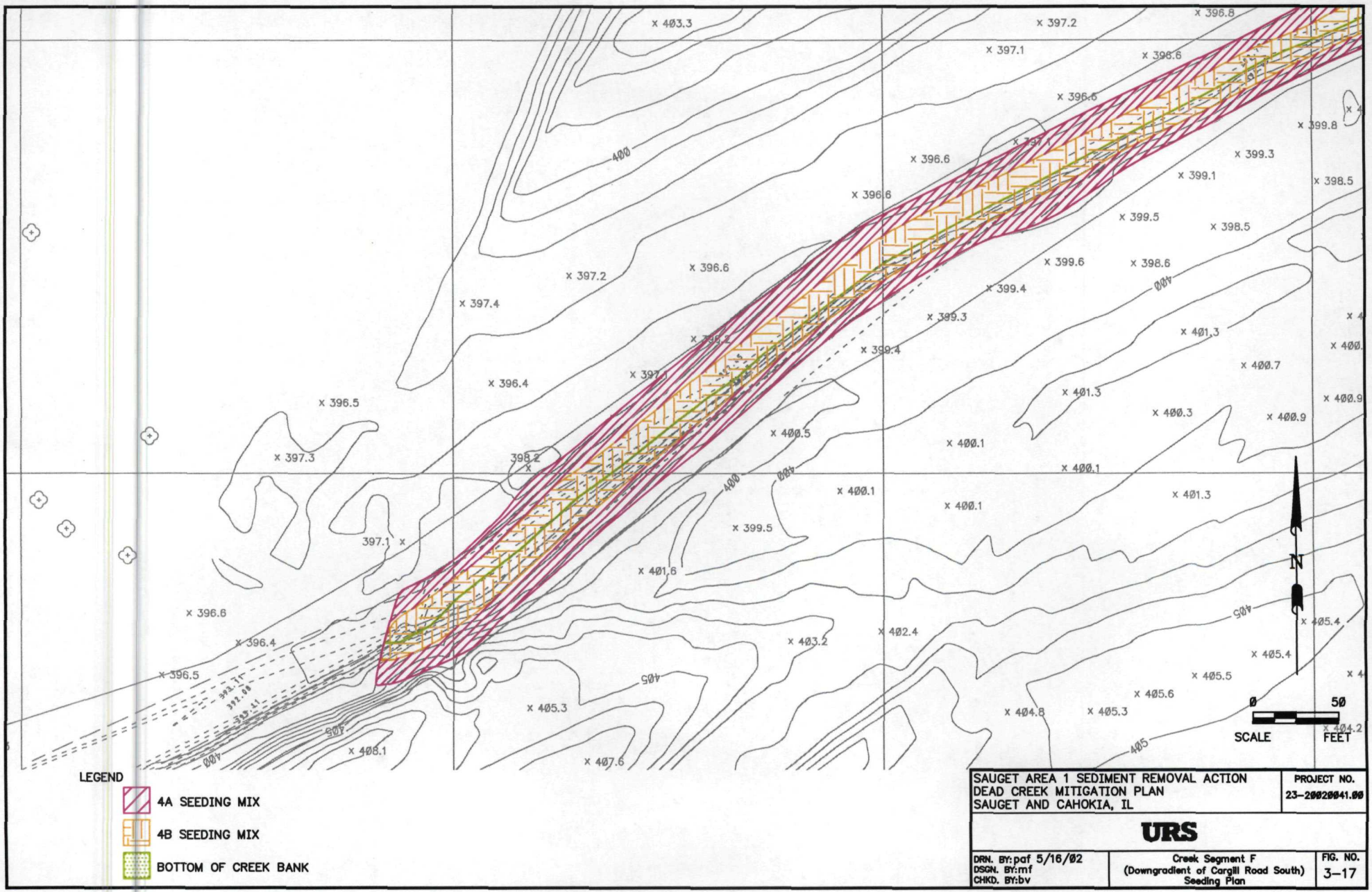

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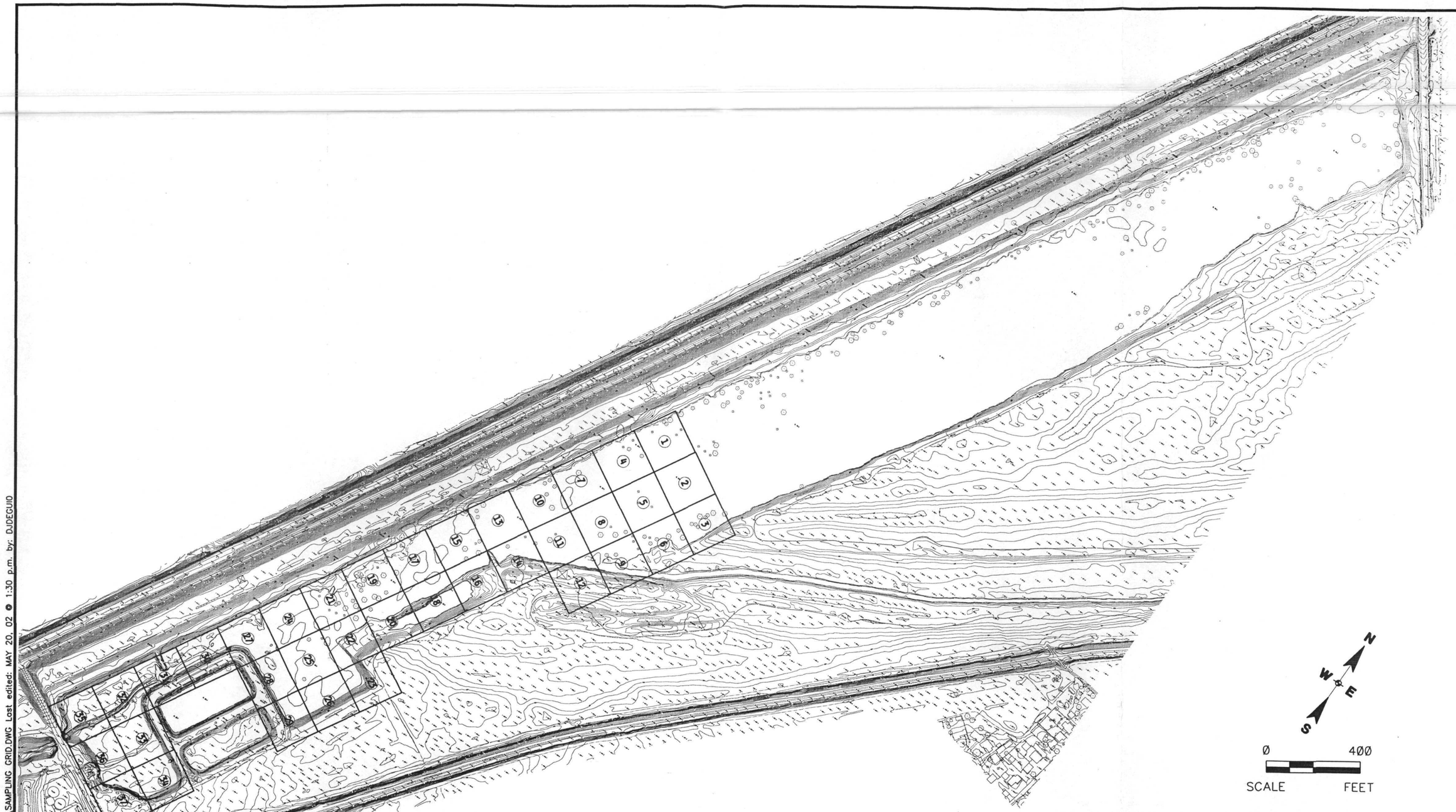


SAUGET AREA 1 SAUGET ILLINOIS	PROJECT NO. 23-20020041.00
URS	
DRN. BY: djd 5/6/02 DSGN. BY: rbv CHKD. BY:	Borrow Pit Lake Investigation Plan Sediment Sampling Locations
	FIG. NO. 4-1

File: E:\232002004100\URS\SAMPLING GRID.DWG Last edited: MAY 20, 02 @ 1:30 p.m. by: DJDEGUIO

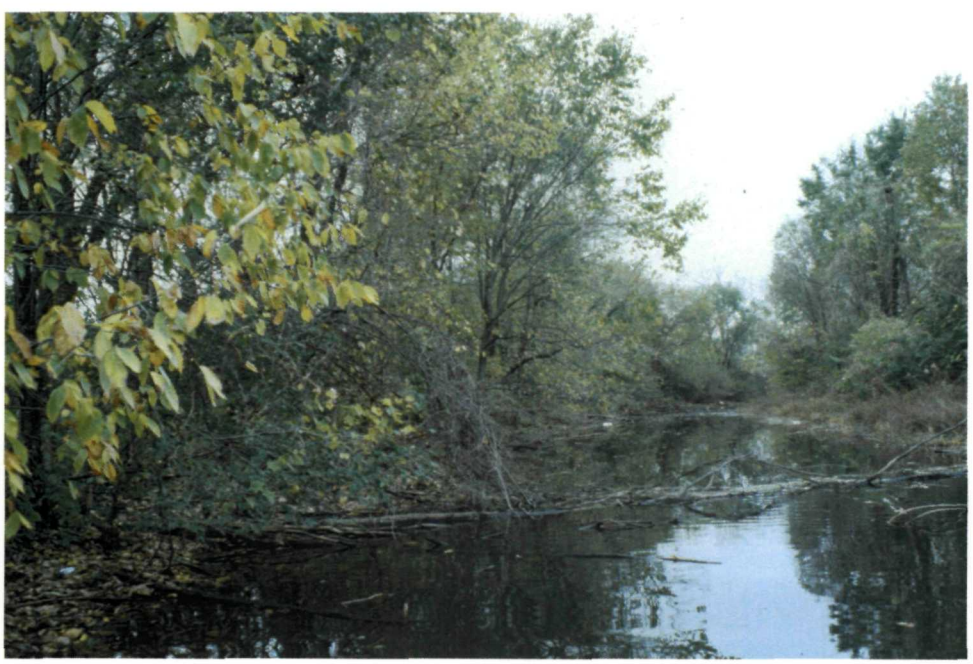
Appendices

APPENDIX 1

Baseline Habitat Assessment

Menzie-Cura & Associates, Inc.

Baseline Habitat Assessment
Dead Creek, Illinois



Prepared by
Woodlot Alternatives, Inc.
Topsham, Maine

January 2001

Table of Contents

1.0 INTRODUCTION

Woodlot Alternatives, Inc. was contracted to perform a baseline habitat assessment along approximately 2.4 km of Dead Creek in Sauget and Cahokia, Illinois. During this assessment, qualitative and quantitative information on plants, animals, vegetation alliances, and hydrologic regimes was collected. This report presents the results of the baseline assessment that can be used to identify organisms potentially at risk from remedial actions. These data can also be used to develop habitat restoration plans.

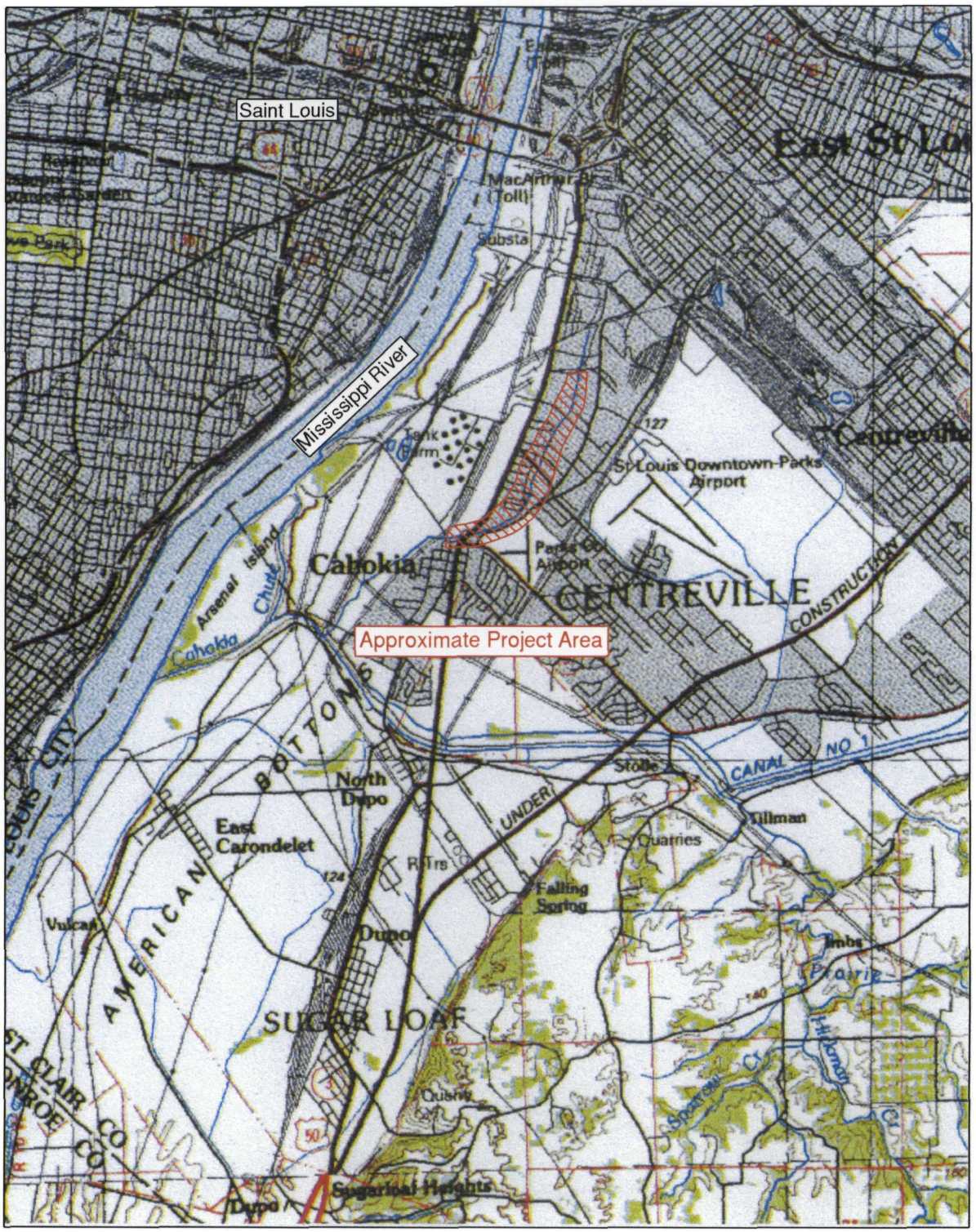
1.1 BACKGROUND

The project area is in Sauget and Cahokia, residential communities (population ca. 200 and 17550 people, respectively) situated south of East St. Louis in St. Clair County, Illinois (Figure 1). Dead Creek was used by various industries prior to the late 1930s as a site for waste discharge (United States Environmental Protection Agency 1996). Impoundments and borrow pits along Dead Creek have also been used for waste and wash water disposal. As a result, chlorinated solvents, chlorobenzenes, polychlorinated biphenyls, various metals, and other substances have come to be located in the sediments of Dead Creek (United States Environmental Protection Agency 1996).

The Dead Creek channel and adjacent riparian communities form a narrow, linear wetland system that passes through suburban Cahokia. Portions of Dead Creek are adjacent to residential and business lots that contain mowed lawns, buildings, driveways, and roads. To a great extent, these areas have been modified so that only relict portions of natural vegetation alliances exist. Furthermore, many areas are also influenced by non-native plant species. Sections of the creek, however, are utilized by rare species monitored by the Illinois Endangered Species Protection Board. This illustrates that Dead Creek does possess value for wildlife habitat and as a travel corridor.

Solutia, Inc. has announced it plans to begin remediation activities along Dead Creek and adjacent source sites in Cahokia and Sauget (Solutia, Inc. 2000).

> Creek Segments B through the upper portion of F are subject to a Unilateral Administrative Order issued by the USEPA on May 31, 2000, to Monsanto Company and Solutia, Inc. (Docket No. V-W-99-C-554) pursuant to section 106(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended, 42 U.S.C. Section 9606(a). The Order requires the following response activities at Sauget Area 1 Creek Segments B and Site M and Creek Segments C, D, E, and F upstream of the Terminal Railroad Association embankment, which are located in Sauget and Cahokia, Illinois (Figure 1-1):
>
> - Preparation of a Time Critical Removal Action Work Plan;
> - Implementation of the Removal Action in accordance with the Work Plan to mitigate the threats posed by presence of contamination in Dead Creek sediments and certain adjacent soils and their potential migration via overflow and flood waters from the Site;



PREPARED BY:

WOODLOT ALTERNATIVES, INC.
122 MAIN STREET, TOPSHAM, MAINE 04086
www.woodlotalt.com

SCALE:	1"=2000'
DATE:	December 2000
PROJ. NO.	100123
DWG. NAME:	study_area.dwg

Study Area Location
Dead Creek Project Area
Baseline Habitat Assessment
Cahokia, Illinois

Source:USGS Topo Quads: Cahokia IL./French Village IL.

REV.

- Removal of materials from CS-B (creek sediments, creek bed soils and flood plain soils); CS-C, D, and E (non-native creek sediments only); and Site M (pond sediments and pond bottom soils) in Sauget Area 1, while minimizing adverse impacts to area wetlands and habitat;
- Proper handling, dewatering, treatment and placement of such materials in the on-site Containment Cell; A plan for management of Dead Creek storm water during the removal action;
- Sampling and analysis of areas where material has been removed, for the purpose of defining remaining contamination;
- Placement of membrane liner material over CS-B and in all other excavated areas where, based on post-removal sample results, such liner is determined to be necessary; and
- Design of a containment cell that will provide adequate protection to human health and the environment.

The Order requires Solutia to conduct these removal activities to abate a potential imminent and substantial endangerment to the public health, welfare or the environment that may be presented by the actual or threatened release of hazardous substances at or from the site.

2.0 METHODS

This section of the report describes the methods used to identify and map vegetation alliances (also referred to as natural communities), characterize the components of each alliance (e.g., wetlands, plants, soils), determine animal use, and describe wetland functions and values in the Dead Creek study area.

2.1 VEGETATION ALLIANCE IDENTIFICATION AND MAPPING

Vegetation alliances were identified during field surveys performed on 2 and 8–11 November 2000. Identification of alliances (or communities) was performed by examination of site hydrology, soils, and landscape location combined with determination of dominant species by strata. Classification of alliances largely followed Drake and Faber-Langendoen (1997) except for unvegetated communities (open water). Wetland communities were also classified according to Cowardin *et al.* (1979). Once identified, the boundaries of each alliance were located in the field using GPS equipment and verified using aerial and land-based photo interpretation. The extent of each community was then plotted on topographic base maps in AutoCAD Release 14. Upon completion of plotting, vegetation alliances were mapped and the areal extent of each alliance calculated.

2.2 VEGETATION ALLIANCE AND WETLAND CHARACTERIZATION

Quantitative and qualitative data regarding plant species abundance and distribution was collected for all dominant vegetation communities. Quantitative data was collected in plots that were 9 m in radius using the methods and performance standards contained in

United States Army Corps of Engineers Wetlands Delineation Manual (1987). While methods contained in this manual were developed for wetland delineation, they also provide a means for collecting quantitative data on plants, soils, and hydrology in upland and riparian habitat. Descriptive data on plant species composition and abundance were collected for trees, lianas (i.e., woody trailing, twining, or climbing plants), saplings, shrubs, seedlings, and herbs. Basal area was measured for trees using a ten-factor prism gauge. Percent areal cover per species was estimated for all other strata. Because the community surveys occurred in late season, some herbaceous plants could not be identified and dominance estimates were likely skewed. Qualitative data collected outside of plots included photographs of each community, a list of all plant species observed, and general descriptions of the ecological integrity of vegetation communities (i.e., degree of anthropogenic disturbance and estimated age of forested communities).

Descriptive data on soils were collated from available reports including the Natural Resource Conservation Service (formerly the Soil Conservation Service) medium intensity soil reports and from soil borings performed on site as part of previous investigations. No new boring or soil analyses were performed. Soil hydrology data were collected from field observations regarding inundation, saturation, and degree of organic matter buildup in the topsoil horizon.

2.3 ANIMAL USE CHARACTERIZATION

Qualitative information on animal use of the project area was collected through direct observation of species or their sign (e.g., tracks, scat, browsing), by a review of previous site investigations, and by comparing habitat available on site to habitat requirements of species known or suspected to occur in or near the project area. Information on aquatic invertebrates and fish was collected from previous site investigation reports and dip net surveys performed during site characterization. In addition, a list of fish species suspected of occurring in Dead Creek was prepared by reviewing range distributions of Illinois fish. Amphibians, reptiles, birds, and mammals seen on the site were recorded, and a list of species that could use the area was developed based on ranges and habitat availability.

2.4 WETLAND FUNCTION-VALUE ASSESSMENT

A wetland function-value assessment was performed for wetlands in the project area to document existing functions and values. The Hydrogeomorphic (HGM) Assessment to Riverine Wetlands system (Brinson *et al.* 1995) was used to the extent possible to assess wetlands and assign values for each function that the wetland provides (e.g., flood control, wildlife habitat, sediment retention). The HGM methodology could not be performed in its entirety because reference wetlands information has not been published and detailed measurements of areal net primary productivity, duration of bank overflow, soil pore space, etc. were not collected during this initial investigation. Its format, however, was followed to provide a qualitative HGM wetland function-value assessment.

3.0 RESULTS AND DISCUSSION

This section describes baseline conditions of the Dead Creek project area and includes: a map showing dominant vegetation alliances and wetland communities; a matrix table of animals known or likely to occur in the Dead Creek corridor; quantitative plant community data; representative photographs of each alliance; a wetland function-value assessment; and narrative descriptions of the site. Common names for species are used throughout the report. Scientific names can be found in Tables 3 and 4.

3.1 VEGETATION ALLIANCE IDENTIFICATION AND MAPPING

Nine vegetation alliances were identified in the Dead Creek project area based on vegetation, landscape position, and hydrological characteristics. These are: *Fraxinus americana–Ulmus americana* Temporarily Flooded Forest, *Populus deltoides* Temporarily Flooded Forest, *Salix nigra* Temporarily Flooded Forest, *Cephalanthus occidentalis* Semi-permanently Flooded Shrubland, *Persicaria*–Mixed Forb Temporarily Flooded Herbaceous, *Typha* Seasonally Flooded Herbaceous, *Potamogeton–Ceratophyllum–Elodea* Permanently Flooded Herbaceous, Temporary Open Water, and Permanent Open Water. The location and extent of each community in the project area is identified on the Wetland Characterization and Vegetative Alliance Map (Sheets 1 through 5). Table 1 presents summary statistics of each community.

3.2 VEGETATION ALLIANCE AND WETLAND CHARACTERIZATION

Both qualitative and quantitative observations of the wetland alliances found in and adjacent to Dead Creek were made during site surveys. Vegetation data was collected in sample plots located throughout the study area and the results are presented in Table 2. A preliminary flora of Dead Creek Areas B through F is presented in Table 3. Explanation of Cowardin (1979) acronyms follows:

- PFO Palustrine Forested Wetland
- PSS Palustrine Scrub-Shrub Wetland
- PEM Palustrine Emergent Wetland
- PAB Palustrine Aquatic Bed
- PUB Palustrine Unconsolidated Bottom
- POW Palustrine Open Water

Table 1. Natural Communities in Dead Creek Study Area.

Natural Communties[1]		Number of Occurrences in Study Area (Areas B - E)[2]	Total Area of Community Type (ha)	Mean Basal Area (m^2/ha)
Vegetation Alliances of Drake and Faber-Langondoen (1997)	**Cowardin *et al.* (1979)**			
Forests	Palustrine Forested Wetland (PFO)	9	3.26	69.29
Fraxinus pennsylvanica-Ulmus americana Temporarily Flooded Forest		4	2.84	60.47
Populus deltoides Temporarily Flooded Forest		4	0.34	83.15
Salix nigra Temporarily Flooded Forest		1	0.08	49.13
Total		9	3.26	
Shrublands	Palustrine Scrub-Shrub Wetland (PSS)	1	0.04	7.56
Cephalanthus occidentalis Semi-permanently flooded shrubland		1	0.04	7.56
Total		1	0.04	
Herbaceous Alliances	Palustrine Emergent Marsh Wetland (PEM)	15	0.87	0.00
	Palustrine Aquatic Bed Wetland (PAB)	8	1.01	0.00
Persicaria-Mixed Forb Temporarily Flooded Herbaceous		13	0.86	0.00
Potamagetan-Ceratophyllun-Elodea Permanently Flooded Herbaceous		8	1.01	0.00
Typha Seasonally Flooded Herbaceous		2	0.01	0.00
Total		23	1.88	
Open Water	Palustrine Unconsolidated Bottom Wetland (PUB)	3	0.26	0.00
	Palustrine Open Water (POW)	4	1.16	0.00
Permanent Open Water		4	1.16	0.00
Temporary Open Water		3	0.26	0.00
Total		4	1.42	

1 = Vegetation alliance classification of Drake and Faber-Langondoen (1997) is based on dominant plant species by strata, landscape position, and hydrology. The wetland classification system of Cowardin *et al.* (1979) is based largely on the tallest dominant strata that is present for vegetated communities.

2 = occurrences separated by stream channel considered to be the same occurrence, those separated by a road are considered different occurrences

Note: Gray shading indicates community characteristics for Cowardin *et al.* classification.

Table 2. Wetland Characterization Plot Data.

Plot	Community[1]	Strata	Plant[2]	Count or Percent Cover[3]	Basal Area (m/ha)[4]	Hydrological Notes	Additional Comments
B-1	*Salix nigra* Temp. Flooded Forest	Tree	*Salix nigra*	8	60.47	scoured channel and silt stains on bank	
		Liana	*Lonicera japonica*	2		shallow rooted trees	
		Liana	*Campsis radicans*	6			
		Liana	*Rubus trivialis*	1			
		Sapling	*Salix nigra*	12			
		Sapling	*Broussonetia papyrifera*	4			
		Shrub	*Broussonetia papyrifera*	5			
		Shrub	*Salix nigra*	2			
		Herb	*Amaranthus tuberculatus*	20	60.47		
B-2	*Persicaria*-Mixed Forb Temp. Flooded	Herb	*Amaranthus tuberculatus*	63		water stained debris, silt lines over bank	
		Herb	*Potentilla norvegica*	0 5		saturated to surface	
		Herb	*Persicaria lapathifolia*	1			
B-3	*Fraxinus-Ulmus* Temp. Flooded Forest	Tree	*Morus alba*	2	15 12	area periodically flooded	area likely flooded during storm events
		Tree	*Ailanthus altissima*	10	75.59	remnant debris lines	
		Liana	*Toxicodendron radicans*	6			
		Liana	*Smilax hispida*	5			
		Liana	*Euonymus fortunei*	31			
		Sapling	*Ailanthus altissima*	14			
		Shrub	*Lonicera maackii*	47			
		Herb	*Equisetum hyemale*	1			
		Herb	*Lonicera maackii*	2			
		Herb	*Sanicula* sp.	1			
		Herb	*Geum canadense*	2	90.71		
B-4	*Fraxinus-Ulmus* Temp. Flooded Forest	Liana	*Ampelopsis cordata*	63		soils saturated at or near surface	
		Liana	*Smilax hispida*	24			
		Liana	*Euonymus fortunei*	3			
		Liana	*Campsis radicans*	6			
		Shrub	*Sambucus canadensis*	10			
		Herb	*Ampelamus albidus*	20			
		Herb	*Solanum ptychanthum*	18			
		Herb	*Eupatorium serotinum*	17			
		Herb	*Amaranthus tuberculatus*	26			
		Herb	*Carex albolutescens*	10			
		Herb	*Potentilla norvegica*	12			
		Herb	*Lycopus americanus*	6			
		Herb	*Bidens vulgata*	3	0 00		
C-1	*Typha* Seasonally Flooded Herbaceous	Sapling	*Acer saccharinum*	3		1-2 cm standing water	
		Shrub	*Acer saccharinum*	1		silt staining on vegetation	
		Herb	*Typha latifolia*	70		organic matter in soil	
		Herb	*Persicaria lapathifolia*	5			
		Herb	*Persicaria emersa*	5			
		Herb	*Lycopus americanus*	15			
		Herb	*Potentilla norvegica*	20			
		Herb	*Carex* sp.	5			
C-2	*Persicaria*-Mixed Forb Temp. Flooded	Herb	*Persicaria lapathifolia*	40		5-7 cm standing water	
		Herb	*Leersia oryzoides*	40		organic matter in soil	
		Herb	*Symphyotrichum lanceolatum*	2			
		Herb	*Lycopus americanus*	1			
		Herb	*Cyperus strigosus*	2			
C-3	*Potamogeton-Ceratophyllum-Elodea* Perm.	Herb	*Ludwigia peploides*	45		15-20 cm standing water	
		Herb	*Alisma subcordatum*	25		high organic content in soil	
		Herb	*Leersia oryzoides*	10			
		Herb	*Persicaria lapathifolia*	2			
		Herb	*Persicaria maculosa*	1			
		Herb	*Eleocharis obtusa*	12			
C-4	*Fraxinus-Ulmus* Temp. Flooded Forest	Tree	*Ulmus americana*	4	30.24	infrequent flooding	
		Tree	*Ailanthus altissima*	3	22.68	(no observable debris line)	
		Liana	*Lonicera japonica*	15			
		Liana	*Toxicodendron radicans*	36			
		Liana	*Campsis radicans*	36			
		Liana	*Smilax hispida*	10			
		Shrub	*Rubus occidentalis*	1			
		Shrub	*Cornus drummondii*	25			
		Shrub	*Ailanthus altissima*	10			
		Herb	*Allium* sp.	8			

C-7	*Fraxinus-Ulmus* Temp. Flooded Forest	Tree	*Ulmus americana*	6	45.35	soils saturated at or near surface	
		Tree	*Acer negundo*	1	7 56	evident debris line	
		Tree	*Ulmus pumila*	1	7 56		
		Liana	*Euonymus fortunei*	32			
		Liana	*Campsis radicans*	30			
		Liana	*Smilax hispida*	5			
		Liana	*Toxicodendron radicans*	6			
		Sapling	*Ulmus americana*	14			
		Shrub	*Cornus drummondii*	18			
		Shrub	*Lonicera maackii*	16			
		Shrub	*Rosa multiflora*	8	60 47		
C-8	*Persicaria*-Mixed Forb Temp Flooded	Herb	*Symphyotrichum lanceolatum*	10		soils saturated to surface	
		Herb	*Leersia oryzoides*	25			
		Herb	*Carex albolutescens*	35			
		Herb	*Lycopus americanus*	5			
		Herb	*Persicaria maculosa*	10			
		Herb	*Potentilla norvegica*	10			
		Herb	*Amaranthus tuberculatus*	8			
		Herb	*Glechoma hederacea*	5			
		Herb	*Torilis arvensis*	1			
D-1	*Potamogeton-Ceratophyllum-Elodea* Perm.	Herb	*Ludwigia peploides*	80		20-25 cm standing water	
		Herb	*Echinodorus berteroi*	1		no discernable flow	
		Herb	*Alisma subcordatum*	1		organic matter in soils	
		Herb	*Leersia oryzoides*	1			
D-2	*Persicaria*-Mixed Forb Temp. Flooded	Liana	*Rubus trivialis*	8		soils saturated to surface	
		Herb	*Persicaria amphibia*	42			This is variety *emersa*
		Herb	*Persicaria lapathifolia*	26			
		Herb	*Lycopus americanus*	6			
		Herb	*Leersia oryzoides*	38			
		Herb	unknown Lamiaceae	5			insufficient material for identification
		Herb	*Glechoma hederacea*	1			
D-3	*Fraxinus-Ulmus* Temp. Flooded Forest	Tree	*Ulmus pumila*	5	37.80	infrequent flooding	
		Tree	*Broussonetia papyrifera*	1	7 56	(no obvious debris line)	
		Tree	*Robinia pseudoacacia*	1	7 56		
		Liana	*Euonymus fortunei*	16			
		Sapling	*Broussonetia papyrifera*	15			
		Shrub	*Sambucus canadensis*	10			
		Shrub	*Morus alba*	43			
		Shrub	*Lonicera maackii*	10			
		Shrub	*Celtis occidentalis*	6			
		Shrub	*Acer negundo*	1			
		Herb	*Allium* sp.	1			insufficient material for identification
		Herb	*Symphyotrichum lanceolatum*	3			
		Herb	*Glechoma hederacea*	1			
		Herb	*Persicaria caespitosa*	1	52.91		
D-4	*Persicaria*-Mixed Forb Temp. Flooded	Liana	*Ampelopsis cordata*	6		saturated to inundated soils	
		Shrub	*Morus alba*	2		frequently flooded	
		Shrub	*Ulmus americana*	2			
		Herb	*Lycopus americanus*	2			
		Herb	*Symphyotrichum lanceolatum*	35			
		Herb	*Leersia oryzoides*	36			
		Herb	*Sparganium* sp.	25			
		Herb	*Cyperus strigosus*	20			
		Herb	*Rumex crispus*	8			
		Herb	*Persicaria lapathifolia*	8			
		Herb	*Carex albolutescens*	5			
E-1	*Cephalanthus* Perm. Flooded Shrubland	Tree	*Acer saccharinum*	1	7 56	standing water present	
		Liana	*Vitis riparia*	8		semi-permanently flooded	
		Sapling	*Acer saccharinum*	16		organic matter in soils	
		Shrub	*Cephalanthus occidentalis*	43			
		Herb	*Persicaria lapathifolia*	10			
		Herb	*Leersia oryzoides*	3			
		Herb	*Lycopus americanus*	1	7 56		
E-2	*Potamogeton-Ceratophyllum-Elodea* Perm.	Herb	*Wolffia borealis*	40		standing water in plot approx. 35 cm	
		Herb	*Lemna perpusilla*	1		*Rana* larvae, topminnow (*Fundulus*)	
		Herb	*Ludwigia peploides*	16		organic matter in soils	
		Herb	*Persicaria punctata*	18			
E-3	*Fraxinus-Ulmus* Temp. Flooded Forest	Tree	*Ulmus americana*	2	15 12	infrequent flooding	
		Tree	*Acer negundo*	1	7.56	(no obvious debris line)	
		Tree	*Juglans nigra*	2	15.12		
		Liana	*Toxicodendron radicans*	12			

		Liana	*Vitis riparia*	8			
		Sapling	*Ulmus americana*	4			
		Shrub	*Cornus drummondii*	40			
		Shrub	*Sambucus canadensis*	20			
		Shrub	*Lonicera maackii*	8			
		Herb	*Hackelia virginiana*	5			
		Herb	*Geum canadense*	7			
		Herb	*Sanicula* sp.	8			insufficient material for identification
		Herb	*Ageratina altissima*	7			
		Herb	*unknown*	5			insufficient material for identification
		Herb	*Carex* sp.	3	37.80		insufficient material for identification
E-4	*Populus deltoides* Temp. Flooded Forest	Tree	*Ulmus pumila*	5	37.80	frequently flooded	
		Tree	*Platanus occidentalis*	2	15.12	debris line present	
		Tree	*Acer negundo*	2	15.12		
		Tree	*Morus alba*	1	7.56		
		Tree	*Populus deltoides*	1	7.56		
		Liana	*Toxicodendron radicans*	14			
		Liana	*Vitis riparia*	16			
		Liana	*Campsis radicans*	1			
		Liana	*Euonymus fortunei*	1			
		Sapling	*Morus alba*	34			
		Shrub	*Celtis occidentalis*	10			
		Shrub	*Lonicera maackii*	2			
		Herb	*Ageratina altissima*	1			
		Herb	*Allium* sp.	1			insufficient material for identification
		Herb	*Sanicula* sp.	1	83.15		insufficient material for identification
E-5	*Populus deltoides* Temp. Flooded Forest	Tree	*Populus deltoides*	8	60.47	seasonally flooded	
		Tree	*Morus alba*	2	15.12	debris line present	
		Tree	*Celtis occidentalis*	1	7.56		
		Tree	*Ulmus rubra*	1	7.56		
		Liana	*Euonymus fortunei*	38			
		Sapling	*Morus alba*	25			
		Sapling	*Acer saccharinum*	10			
		Sapling	*Celtis occidentalis*	6			
		Shrub	*Celtis occidentalis*	5			
		Shrub	*Ulmus rubra*	5			
		Shrub	*Lonicera maackii*	5			
		Herb	*Ageratina altissima*	10			
		Herb	*Persicaria punctata*	2			
		Herb	*Carex* sp.	4	90.71		insufficient material for identification
E-6	*Potamogeton-Ceratophyllum-Elodea* Perm.	Herb	*Alisma subcordatum*	15		30+ cm of standing water	
		Herb	*Leersia oryzoides*	25		organic matter in soils	
		Herb	*Symphyotrichum lanceolatum*	3			
		Herb	*Persicaria punctata*	1			
		Herb	*Sagittaria montevidensis*	1			material is var. calycina
		Herb	*Bidens vulgata*	1			
		Herb	*Rumex crispus*	1			
F-1	*Populus deltoides* Temp. Flooded Forest	Tree	*Populus deltoides*	7	52.91	seasonally flooded	
		Tree	*Ulmus americana*	2	15.12	debris line present	
		Tree	*Ulmus pumila*	1	7.56		
		Liana	*Toxicodendron radicans*	8			
		Liana	*Smilax hispida*	8			
		Liana	*Euonymus fortunei*	18			
		Sapling	*Celtis occidentalis*	15			
		Sapling	*Ulmus pumila*	2			
		Sapling	*Albizzia julibrissin*	4			
		Shrub	*Celtis occidentalis*	2			
		Shrub	*Cornus drummondii*	15			
		Shrub	*Morus alba*	18			
		Shrub	*Acer negundo*	8			
		Shrub	*Ulmus pumila*	2			
		Shrub	*Lonicera maackii*	11			
		Herb	*Ageratina altissima*	4			
		Herb	*Allium* sp.	1			insuficient material for identification
		Herb	*Carex* sp.	1	75.59		insuficient material for identification

1=Community classification follows Drake and Faber-Langendoen (1997).
2=Taxonomy follows Haines and Vining (1998) where applicable and otherwise follows Flora of North America Editorial Committee (in ed.).
3=Counts provided for trees represent sampling with a 10-factor prism, otherwise counts represent areal coverage.
4=Basal area counts are provided for individual species in each plot and as well as cumulative counts located in the lowest row for the plot.

Table 3. Preliminary Flora of Dead Creek Project Area.

Plant Names		Present in the Following Natural Communities							Native to Illinois	Notes
Species Latin Name	Species Common Name	*Salix nigra* Temporarily Flooded Forest Alliance	*Populus deltoides* Temporarily Flooded Forest Alliance	*Fraxinus pennsylvanica-Ulmus americana* Temporarily Flooded Forest Alliance	*Cephalanthus occidentalis* Semi-permanently Flooded Shrubland Alliance	*Typha* Seasonally Flooded Herbaceous Alliance	*Persicaria*-Mixed Forb Temporarily Flooded Herbaceous Alliance	*Potamogeton-Ceratophyllum-Elodea* Permanently Flooded Herbaceous Alliance		
Acalypha rhomboidea	three-seeded mercury						X		yes	
Acer negundo	box elder		X	X					yes	
Acer rubrum	red maple			X					yes	
Acer saccharinum	silver maple		X	X	X	X			yes	
Ageratina altissima	white snakeroot		X	X					yes	
Ailanthus altissima	tree-of-heaven			X					no	dominant in portions of Area B
Albizzia julibrissin	silk-tree		X	X					no	
Alisma subcordatum	southern water-plantain							X	yes	
Allium sp.	an onion		X	X						insufficient material for identification
Amaranthus tuberculatus	rough-fruited water-hemp	X					X		yes	dominant in portions of Area B
Ampelamus albidus	sandvine			X					yes	
Ampelopsis cordata	raccoon-grape			X					yes	
Apocynum sp.	a dogbane			X						insufficient material for identification
Asclepias incarnata	swamp milkweed						X		yes	
Bidens bipinnata	Spanish needles			X					yes	
Bidens vulgata	tall beggar ticks			X					yes	
Boehmeria cylindrica	false nettle						X		yes	
Broussonetia papyrifera	paper mulberry	X		X					no	
Calystegia sepium	hedge-bindweed			X			X		yes	
Campsis radicans	trumpet-creeper	X		X					no	
Carex albolutescens	greenish-white sedge		X	X					yes	
Carex sp.	sedge					X				insufficient material for identification
Catalpa speciosa	northern catalpa		X	X					no	
Celtis occidentalis	northern hackberry		X	X					yes	frequent in sapling stratum
Cephalanthus occidentalis	buttonbush				X				yes	
Chenopodium berlandieri var. *bushianum*	pitseed goosefoot						X		yes	
Cornus drummondii	rough-leaved dogwood		X	X					yes	frequent shrub in study area
Cyperus strigosus	false nutsedge	X					X		yes	
Dactylis glomerata	orchard grass								no	
Desmodium sp.	a tick-trefoil									insufficient material for identification
Duchesnea indica	indian strawberry						X		no	
Echinochloa crus-galli	barnyard grass						X		no	
Echinodorus berteroi	tall bur-head							X	yes	
Eleocharis obtusa	blunt spikesedge						X	X	yes	
Elymus canadensis	Canada wild-rye								yes	
Elymus macregorii	early wild-rye			X					yes	a potentially rare species
Elymus virginicus	Virginia wild-rye			X					yes	
Equisetum hyemale	common scouring-rush			X					yes	
Erechtites hieraciifolia	pilewort	X							yes	
Euonymus fortunei	Chinese spindle-tree		X	X					no	prevalent in project area
Eupatorium serotinum	late eupatorium			X					yes	
Fallopia scandens	false buckwheat								yes	
Forsythia viridissima	greenstem forsythia			X					no	
Fraxinus americana	white ash			X					yes	
Galium asprellum	rough bedstraw			X					yes	
Geum canadense	white avens			X					yes	
Glechoma hederacea	gill-over-the-ground			X					no	
Hackelia virginiana	Virginia stickseed			X					yes	
Humulus japonicus	Japanese hops						X		no	
Juglans nigra	black walnut			X					yes	
Lactuca biennis	tall blue lettuce			X					yes	
Leersia oryzoides	rice cut-grass				X		X	X	yes	common wetland herb
Lemna perpusilla	minute duckweed							X	yes	
Lolium arundinaceum	reed fescue			X					no	
Lonicera japonica	Japanese honeysuckle	X		X					no	

Lonicera maackii	Amur honeysuckle		X	X					no	prevalent in project area
Ludwigia peploides	floating primrose-willow							X	yes	common aquatic herb
Lycopus americanus	American water-horehound				X	X	X		yes	
Menispermum canadense	moonseed			X					yes	
Morus alba	white mulberry		X	X					no	prevalent in project area
Muhlenbergia bushii	Bush's muhly			X					yes	
Oenothera parviflora	small-flowered evening-primrose		X	X					yes	
Persicaria amphibia var. *emersa*	water smartweed						X		no	
Persicaria caespitosa	a smartweed						X		no	
Persicaria lapathifolia	dock-leaved smartweed				X	X	X	X	yes	common wetland herb
Persicaria maculosa	lady's thumb						X	X	no	
Persicaria punctata	dotted smartweed		X				X		yes	
Persicaria sagittata	arrow-leaved tear-thumb			X					yes	
Philadelphus sp.	a mock-orange			X					no	
Phytolacca americana	pokeweed								yes	
Pilea pumila	clearweed			X					yes	
Platanus occidentalis	sycamore		X	X					yes	among largest trees in project area
Populus deltoides	eastern cottonwood		X						yes	among largest trees in project area
Potentilla norvegica	rough cinquefoil			X		X	X		yes	
Prunus serotina	black cherry			X					yes	
Quercus rubra	red oak			X					yes	
Rhus glabra	smooth sumac			X					yes	
Robinia pseudoacacia	black locust			X					no	
Rosa multiflora	multiflora rose			X					no	
Rubus bifrons	a blackberry			X					no	
Rubus occidentalis	black raspberry			X					yes	
Rubus trivialis	coastal-plain dewberry	X		X					yes	
Rumex crispus	curly dock						X		no	
Rumex obtusifolius	bitter dock						X		no	
Sagittaria montevidensis var. *calycina*	Mississippi arrowhead							X	yes	
Salix caroliniana	Carolina willow			X					yes	
Salix nigra	black willow	X							yes	dominant in upstream Area B
Sambucus canadensis	common elder			X					yes	
Sanicula sp.	a sanicle			X						insufficient material for identification
Scrophularia marilandica	eastern figwort			X					yes	
Setaria pumila	pigeon grass						X		no	
Smilax hispida	hispid greenbriar		X	X					yes	
Solanum ptychanthum	eastern black nightshade			X					yes	
Solidago altissima	tall goldenrod						X		yes	
Sorghum halapense	Johnson-grass			X					no	
Sparganium sp.	a bur-reed							X		insufficient material for identification
Stellaria media	common chickweed								no	
Symphyotrichum ericoides	white squarrose aster								yes	
Symphyotrichum lanceolatum	eastern lined aster						X		yes	
Symphyotrichum pilosum	awl aster								yes	
Torilis arvensis	field hedge-parsley			X			X		no	
Toxicodendron radicans	poison ivy			X					yes	
Trifolium repens	white clover		X						no	
Typha latifolia	broad-leaved cattail					X			yes	
Ulmus americana	American elm			X					yes	
Ulmus pumila	Siberian elm			X					no	prevalent in project area
Ulmus rubra	slippery elm		X	X					yes	
Urtica dioica	stinging-nettle						X			subspecies not determined
Verbascum thapsus	common mullein			X					no	
Verbena urticifolia	white vervain			X			X		yes	
Viola sp.	a violet			X						insufficient material for identification
Vitis riparia	river grape	X		X					yes	
Wolffia borealis	watermeal							X	yes	important waterfowl food
Xanthium strumarium	common cocklebur						X		no	

Table 4. Animal Species Known or Likely to Occur in Dead Creek Study Area.

Common Name	Genus	Specific Epithet	State Status	Notes	Aquatic System[2]	Terrestrial--Wetland Systems[2]
BIRDS						
Acadian flycatcher	*Empidonax*	*virescens*				B
American bittern	*Botaurus*	*lentiginosus*	Endangered			B
American black duck	*Anas*	*rubripes*			W	W
American coot	*Fulica*	*americana*			Y	
American Crow	*Corvus*	*brachyrhynchos*				Y
American goldfinch	*Carduelis*	*tristis*				Y
American Kestrel	*Falco*	*sparverius*				Y
American red-start	*Setophaga*	*ruticilla*				B
American robin	*Turdus*	*migratorius*				Y
American tree sparrow	*Spizella*	*arborea*				W
American wigeon	*Anas*	*americana*			W	W
American woodcock	*Scolopax*	*minor*				B
Baltimore oriole	*Icterus*	*galbula*				B
bank swallow	*Riparia*	*riparia*				B[1]
barn swallow	*Hirundo*	*rustica*				B
barred owl	*Strix*	*varia*				Y
bay-breasted warbler	*Dendroica*	*castanea*				W
belted kingfisher	*Ceryle*	*alcyon*			B	B
black-capped chickadee	*Poecile*	*atricapillus*				Y
black-crowned night-heron	*Nycticorax*	*Nycticorax*	Endangered		B	B
black-throated green warbler	*Dendroica*	*virens*				W
blackpoll warbler	*Dendroica*	*striata*				W
blue jay	*Cyanocitta*	*cristata*				Y
blue-gray gnatcatcher	*Polioptila*	*caerulea*				B
blue-winged teal	*Anas*	*discors*			B	B
blue-winged warbler	*Vermivora*	*pinus*				B
broad-winged hawk	*Buteo*	*platypterus*				B
brown creeper	*Certhia*	*americana*	Threatened			Y
brown thrasher	*Toxostoma*	*rufum*				B
brown-headed cowbird	*Molothrus*	*ater*				W
Canada goose	*Branta*	*canadensis*			Y	Y
Carolina chickadee	*Poecile*	*carolinensis*				Y
Carolina wren	*Thryothorus*	*ludovicianus*				Y
cattle egret	*Bubulcus*	*ibis*				B
cedar waxwing	*Bombycilla*	*cedrorum*				Y
chestnut-sided warbler	*Dendroica*	*pensylvanica*				B
chimney swift	*Chaetura*	*pelagica*				B
chipping sparrow	*Spizella*	*passerina*				B
cliff swallow	*Hirundo*	*pyrrhonota*				B[1]
common grackle	*Quiscalus*	*quiscula*				Y
common nighthawk	*Chordeiles*	*minor*				B
common snipe	*Gallinago*	*gallinago*	Watch List			B
common yellowthroat	*Geothlypis*	*trichas*				B
dark-eyed junco	*Junco*	*hyemalis*				W
dickcissel	*Spiza*	*americana*				B
downy woodpecker	*Picoides*	*pubescens*				Y
eastern bluebird	*Sialia*	*sialis*				B
eastern kingbird	*Tyrannus*	*tyrannus*				B
eastern meadowlark	*Sturnella*	*magna*				Y
eastern phoebe	*Sayornis*	*phoebe*				B
eastern towhee	*Pipilo*	*erythrophthalmus*				Y
eastern wood-pewee	*Contopus*	*virens*				B
Eurasian tree sparrow	*Passer*	*montanus*		species locally introduced in St. Louis Area		Y
European starling	*Sturnus*	*vulgaris*		introduced to North America		Y
field sparrow	*Spizella*	*pusilla*				Y
fox sparrow	*Passerella*	*iliaca*				W
gadwall	*Anas*	*strepera*			W	W
golden-crowned kinglet	*Regulus*	*satrapa*				W

grasshopper sparrow	*Ammodramus*	*savannarum*				B
gray catbird	*Dumetella*	*carolinensis*				B
great blue heron	*Ardea*	*herodias*			Y	Y
great crested flycatcher	*Myiarchus*	*crinitus*				B
great horned owl	*Bubo*	*virginianus*				Y
greater yellowlegs	*Tringa*	*melanoleuca*			W	W
green heron	*Butorides*	*virescens*			B	B
green-winged teal	*Anas*	*crecca*			Y	Y
hairy woodpecker	*Picoides*	*villosus*				Y
herring gull	*Larus*	*argentatus*			Y	
hooded merganser	*Lophodytes*	*cucullatus*			Y	Y
house finch	*Carpodacus*	*mexicanus*		introduced to North America		Y
house sparrow	*Passer*	*domesticus*		introduced to North America		Y
house wren	*Troglodytes*	*aedon*				B
indigo bunting	*Passerina*	*cyanea*				B
Kentucky warbler	*Oporornis*	*formosus*				B
killdeer	*Charadrius*	*vociferus*				Y
least flycatcher	*Empidonax*	*minimus*				B
little blue heron	*Egretta*	*caerulea*	Endangered		B	B
mallard	*Anas*	*platyrhynchos*			B	B
mourning dove	*Zenaida*	*macroura*				Y
Nashville warbler	*Vermivora*	*ruficapilla*				W
northern bobwhite	*Colinus*	*virginianus*				Y
northern cardinal	*Cardinalis*	*cardinalis*				Y
northern flicker	*Colaptes*	*auratus*				Y
northern mockingbird	*Mimus*	*polyglottos*				Y
northern parula	*Parula*	*americana*				B
northern pintail	*Anas*	*acuta*				W
northern rough-winged swallow	*Stelgidopteryx*	*serripennis*				B
northern shoveler	*Anas*	*clypeata*			W	W
northern waterthrush	*Seiurus*	*noveboracensis*				B
orange-crowned warbler	*Vermivora*	*celata*				W
orchard oriole	*Icterus*	*spurius*				B
palm warbler	*Dendroica*	*palmarum*				W
pied-billed grebe	*Podilymbus*	*podiceps*	Threatened			Y
prothonotary warbler	*Protonotaria*	*citrea*				B
purple martin	*Progne*	*subis*				B
red-bellied woodpecker	*Melanerpes*	*carolinus*				Y
red-eyed vireo	*Vireo*	*olivaceus*				B
red-headed woodpecker	*Melanerpes*	*erythrocephalus*				Y[1]
red-tailed hawk	*Buteo*	*jamaicensis*				Y
red-winged blackbird	*Agelaius*	*phoeniceus*				Y
ring-billed gull	*Larus*	*delawarensis*			Y	
rock dove	*Columba*	*livia*				Y
rose-breasted grosbeak	*Pheucticus*	*ludovicianus*				B
ruby-crowned kinglet	*Regulus*	*calendula*				W
ruby-throated hummingbird	*Archilochus*	*colubris*				B
rusty blackbird	*Euphagus*	*carolinus*				W
savannah sparrow	*Passerculus*	*sandwichensis*				W
semipalmated sandpiper	*Calidris*	*pusilla*			W	W
snowy egret	*Egretta*	*thula*	Endangered		B[1]	B[1]
solitary sandpiper	*Tringa*	*solitaria*			W	W
song sparrow	*Melospiza*	*melodia*				Y
sora	*Porzana*	*carolina*			B	B
spotted sandpiper	*Actitus*	*macularia*			B	B
Swainson's thrush	*Catharus*	*ustulatus*				B
swamp sparrow	*Melospiza*	*georgiana*				B
Tennessee warbler	*Vermivora*	*peregrina*				W
tree swallow	*Tachycineta*	*bicolor*				Y
tufted titmouse	*Baeolophus*	*bicolor*				Y
turkey vulture	*Cathartes*	*aura*				Y
vesper sparrow	*Pooecetes*	*gramineus*				W
warbling vireo	*Vireo*	*gilvus*				B
whip-poor-will	*Caprimulgus*	*vociferus*				B
white-breasted nuthatch	*Sitta*	*carolinensis*				Y
white-eyed vireo	*Vireo*	*griseus*				B

white-crowned sparrow	*Zonotrichia*	*leucophrys*				Y
white-throated sparrow	*Zonotrichia*	*albicollis*				Y
Wilson's warbler	*Wilsonia*	*pusilla*				W
wood duck	*Aix*	*sponsa*			B	B
worm-eating warbler	*Helmitheros*	*vermivorus*				B
yellow warbler	*Dendroica*	*petechia*				B
yellow-billed cuckoo	*Coccyzus*	*americanus*				B
yellow-breasted chat	*Icteria*	*virens*				B
yellow-crowned night heron	*Nyctanassa*	*violacea*	Endangered		B	B
yellow-rumped warbler	*Dendroica*	*coronata*				W
yellow-throated vireo	*Vireo*	*flavifrons*				B
MAMMALS						
beaver	*Castor*	*canadensis*		herbivory observed		Y
big brown bat	*Eptesicus*	*fuscus*				Y
common muskrat	*Ondatra*	*zibethicus*		dens observed		Y
coyote	*Canis*	*latrans*				Y
deer mouse	*Peromyscus*	*maniculatus*				Y
eastern chipmunk	*Tamias*	*striatus*				Y
eastern cottontail	*Sylvilagus*	*floridanus*				Y
eastern gray squirrel	*Sciurus*	*carolinensis*				Y
eastern mole	*Scalopus*	*aqauticus*				Y
eastern pipistrelle	*Pipistrellus*	*subflavus*				Y
gray fox	*Urocyon*	*cinereoargenteus*				Y
hoary bat	*Lasiurus*	*cinereus*				B
house mouse	*Mus*	*musculus*				Y
least shrew	*Cryptotis*	*parva*				Y
little brown myotis	*Myotis*	*lucifugus*				Y
long-tailed weasel	*Mustela*	*frenata*				Y
masked shrew	*Sorex*	*cinereus*				Y
meadow vole	*Microtus*	*pennsylvanicus*				Y
mink	*Mustela*	*vison*				Y
northern short-tailed shrew	*Blarina*	*brevicauda*				Y
Norway rat	*Rattus*	*norvegicus*				Y
raccoon	*Procyon*	*lotor*		tracks observed		Y
red bat	*Lasiurus*	*borealis*				Y
red fox	*Vulpes*	*vulpes*				Y
silver-haired bat	*Lasionycteris*	*noctivagans*				W
striped skunk	*Mephitis*	*mephitis*				Y
Virginia opossum	*Didelphis*	*virginiana*				Y
white-footed mouse	*Peromyscus*	*leucopus*				Y
white-tailed deer	*Odocoileus*	*virginianus*				Y
woodchuck	*Marmota*	*monax*				Y
HERPETILES						
American Toad	*Bufo*	*americanus*			B	B
black racer	*Coluber*	*constrictor*				B
broad-headed skink	*Eumeces*	*laticeps*				B
brown snake	*Storeria*	*dekayi*				B
bullfrog	*Rana*	*catesbeiana*			B	B
common garter snake	*Thamnophis*	*sirtalis*				B
Cope's gray treefrog	*Hyla*	*chrysoscelis*			B	B
crawfish frog	*Rana*	*areolata*			B	B
eastern box turtle	*Terrapene*	*carolina*			B	B
eastern gray treefrog	*Hyla*	*versicolor*			B	B
eastern milk snake	*Lampropeltis*	*triangulum*				B
eastern narrowmouth toad	*Gastrophryne*	*carolinensis*			B	B
eastern newt	*Notophthalmus*	*viridescens*			B	
eastern spadefoot	*Scaphiopus*	*holbrookii*			B	B
false map turtle	*Graptemys*	*pseudogeographica*			B	B
five-lined skink	*Eumeces*	*fasciatus*				B
Fowler's toad	*Bufo*	*fowleri*			B	B
fox snake	*Elaphe*	*vulpina*				B
Graham's crayfish snake	*Regina*	*grahamii*			B	B
green frog	*Rana*	*clamitans*			B	B
lesser siren	*Siren*	*intermedia*			B	
lined snake	*Tropidoclonion*	*lineatum*				B
milk snake	*Lampropeltis*	*triangulum*				B

northern cricket frog	*Acris*	*crepitans*			B	B
northern water snake	*Nerodia*	*sipedon*			B	B
painted turtle	*Chrysemys*	*picta*			B	B
plains garter snake	*Thamnophis*	*radix*			B	B
rat snake	*Elaphe*	*obsoleta*				B
rough green snake	*Opheodrys*	*aestivus*				B
red-eared slider	*Trachemys*	*scripta*		variety *elegans*	B	B
smallmouth salamander	*Ambystoma*	*texanum*			B	B
snapping turtle	*Chelydra*	*serpentina*			B	B
southern leopard frog	*Rana*	*sphenocephala*			B	B
spiny softshell	*Apalone*	*spinifera*			B	B
spotted salamander	*Ambystoma*	*maculatum*			B	B
spring peeper	*Pseudacris*	*crucifer*			B	B
striped chorus frog	*Pseudacris*	*triseriata*			B	B
tiger salamander	*Ambystoma*	*tigrinum*			B	B
western ribbon snake	*Thamnophis*	*proximus*				B
FISH						
black bullhead	*Ameiurus*	*melas*		variety of habitats with turbid water and slow current	Y	
blackstripe topminnow	*Fundulus*	*notatus*		moderate turbidity, slow current, mud bottom	Y	
fathead minnow	*Pimephales*	*promelas*		tolerates extremes in turbidity, temperature, and oxygen	Y	
green sunfish	*Lepomis*	*cyanellus*		tolerates extremes in turbidity, temperature, and oxygen	Y	
johnny darter	*Etheostoma*	*nigrum*		slow current and mud (or sand and gravel) bottom	Y	
mosquitofish	*Gambusia*	*affinis* or *holbrookii*		wide variety and quality of habitats; taxonomy uncertain	Y	
red shiner	*Cyprinella*	*lutrensis*		variety of habitats, tolerates turbidity	Y	

1 = species documented to occur in project area by previous site investigators (information supplied by Menzie-Cura & Associates, Inc.)

2 = explanation of codes

Seasonal Use

Y=potential year round use of project area
B=likely present only during summer breeding season
W=likely present only during migration and/or winter season

Grey shading indicates species observed in project area

3.21 Vegetation Alliance Descriptions

3.211 Forests

Forests are typically defined as areas with greater than 65 percent areal cover of trees. This definition was broadened in the Dead Creek study area to also include areas that had been cleared of canopy-sized trees and were in various stages of recovery or succession. This concept was used because Drake and Faber-Langendoen (1997) do not provide classification for anthropogenic habitats and these communities will ultimately recover as forests if protected from further disturbance.

SALIX NIGRA TEMPORARILY FLOODED FOREST ALLIANCE — PFO

This forested alliance occurs along riparian corridors of streams and rivers and is subject to flooding during high water events. It is identified by the dominance of black willow in the canopy. In Illinois, other tree species may also occur to a lesser extent, including eastern cottonwood, sycamore, river birch, and green ash. No other tree species occurred with black willow in the study area. The canopy was sparse and estimated to possess 40 percent areal cover. The larger trees measured 35 cm in diameter and were 45 years old. Lianas were prevalent and included Japanese honeysuckle, trumpet-creeper, and coastal-plain dewberry. Additional plants of this alliance included paper mulberry, rough-fruited water-hemp, and false nutsedge. The stream channel of this community was scoured and consisted of sand and gravel. Both water flow velocity and substrate (moderately fast and scoured, respectively) were unique to the study area. This natural community was found only near the upstream end of the study area adjacent to Queeny Avenue.

FRAXINUS PENNSYLVANICA–ULMUS AMERICANA TEMPORARILY FLOODED FOREST ALLIANCE — PFO

This forested alliance occurs along riverbanks and floodplains. It is subject to flooding during high water events. The frequency of flooding the vegetation alliance experiences is dependent on the community elevation above the river channel. For example, some occurrences of this alliance were on relatively high banks and would not be flooded as frequently as those occurring on low areas adjacent to the creek channel. This community varied in the study area relative to the amount of disturbance to the canopy and prevalence of non-native species. In some areas, such as north of Judith Lane, the tree stratum was nearly absent and dense thickets of native and non-native lianas blanketed the slope and low vegetation. Dominant species in this disturbed forest setting included raccoon-grape, hispid greenbriar, Chinese spindle-tree, and trumpet-creeper.

A second manifestation of this community was dominated by non-native tree species. Frequent canopy species in this setting included white mulberry, Siberian elm, and tree-of-heaven. The final form of this community in the study area was dominated by native tree species. Common trees included American elm, white ash, box elder, and limited stems of silver maple and black walnut. Non-native canopy species were sometimes intermixed in this last form of the community. Throughout the study area, common saplings and shrubs of this community included paper mulberry, Amur honeysuckle, common elder, and rough-leaved dogwood. The former two species are aggressive, non-native species. White snakeroot, white avens, and false nettle were common herbaceous species. Canopy height and age varied with location and species composition. In many areas the majority of trees were shorter than 15 m, had stems 10–20 cm in diameter, and were up to 15 years old. The largest trees in this community were often escaped Siberian elms (50 cm in diameter or larger).

POPULUS DELTOIDES TEMPORARILY FLOODED FOREST ALLIANCE — PFO

This forested alliance is found within riparian corridors of streams and rivers. It is inundated for short periods of time during high water events. The community is recognized by its dominance of tall, deciduous trees with eastern cottonwood as the primary canopy component. In the study area, eastern cottonwood is the most frequent species, with sycamore, box elder, and American elm often present. White mulberry and Siberian elm were frequent non-native trees. Understory woody species included northern hackberry, Chinese spindle-tree, and Amur honeysuckle. Herbaceous species were both scarce and patchy in distribution. Common species were white snakeroot and dotted smartweed. The canopy of this alliance exceeded 20 m in height, with the larger trees 80–200 cm in diameter and up to 70 years old. Substrate varies for this community throughout its range; from bare, newly formed alluvial bars to floodplain flats and terraces. Substrate also varied within the study area.

3.212 Shrublands

Shrublands are areas that lack complete tree canopies during mature stages. Though some trees are generally present, the dominant stratum in the alliance is the shrub layer.

The small, woody vegetation usually occurs in broken mats or clumps with exposed substrate (soil or water) and herbaceous plants in between.

CEPHALANTHUS OCCIDENTALIS SEMI-PERMANENTLY FLOODED SHRUBLAND — PSS

As its name indicates, this alliance is a shrub-dominated alliance with buttonbush representing the majority of cover. In the study area, this habitat was limited to a small occurrence immediately downstream of Jerome Lane. Canopy-sized trees were scarce and limited to small silver maples on the margin of the alliance. The shrub layer was almost entirely dominated by buttonbush growing in about 20 cm of water. These shrubs grew in thicket-like colonies with open water and herbs interspersed between them. Some silver maple saplings were present in this stratum as well. Dock-leaved smartweed and rice cut-grass were the dominant herbs.

3.213 Herbaceous Alliances

Similar to shrublands, herbaceous alliances are those communities that lack complete tree canopies. In this case, however, the dominant stratum was the herb layer; these communities had very little above ground living material in the winter season, though dead persistent stems may have occurred.

TYPHA SEASONALLY FLOODED HERBACEOUS — PEM

This vegetation alliance is identified by the dominance of grass-like herbs (usually cattails) growing in seasonally flooded soils. Within the project area, this natural community was limited to two small occurrences: one immediately downstream of Judith Lane and a second occurrence near Falling Springs Road. Silver maple was the only woody species to occupy this community, and it was limited to a few saplings and seedlings. Broad-leaved cattail dominated the alliance and formed a thick stand of emergent vegetation. Other common herbs included rough cinquefoil, American water-horehound, and dock-leaved smartweed. Standing water was present during the survey to a depth of 10 cm.

PERSICARIA–MIXED FORB TEMPORARILY FLOODED HERBACEOUS — PEM

This vegetation alliance is very diverse and poorly defined. It typically occurs as exposed, saturated soil that has been uncovered as temporary pools recede during the growing season. Herbaceous species are reported to sometimes differ from year to year. In the study area, this alliance had two different forms based on substrate exposure. In the upstream portion of the study area, above Judith Lane, the community was almost entirely dominated by tall stems of rough-fruited water-hemp with tiny smartweed seedlings underneath. These plants occurred on exposed, wet mud at the edge of an open water channel. Downstream of Judith Lane, the community grew in shallow water and at the edge of the bank. The soil was nearly covered by vegetation, water, and/or leaf litter with very limited exposed mineral soil. Dock-leaved smartweed and rice cut-grass were herbaceous species that were nearly always present. Other frequent species in this form of the alliance were eastern lined-aster, water smartweed, dotted smartweed, and American water-horehound. Water depth ranged from 0 to mostly less than 15 cm deep in this community.

POTAMOGETON–CERATOPHYLLUM–ELODEA PERMANENTLY FLOODED HERBACEOUS — PAB

This vegetation alliance is another variable and poorly defined community. It is described as typically possessing standing water less than 2 m deep with less than 25 percent emergent or floating-leaved plants and often 25 percent or more submerged vegetation. In the study area, this vegetation alliance was generally dominated by floating primrose-willow and southern water-plantain. Several other species were present to lesser extent, including rice cut-grass, dotted smartweed, minute duckweed, watermeal, Mississippi arrowhead, and tall bur-head. Water depth commonly ranged from 10–50 cm in this community.

3.214 Open Water Communities

The open water community is defined as areas of standing water that lacked sufficient aquatic vegetation to be considered as one of the herbaceous alliances. In the study area,

this community occurred in several locations and, in some instances, appeared to be shade or water persistence related.

TEMPORARY OPEN WATER — PUB

This natural community was located in the upstream portion of the study area above Judith Lane (Area B). It is best described as a long channel of shallow water (usually less than 50 cm deep) that is dependent on relatively recent precipitation to maintain its level.

Portions of the shore and central channel were devoid of water and saturated substrate (firm mud) was exposed. Following a rain event during the site survey, these previously exposed areas had become inundated again. It was apparent through examination of the substrate and vegetation that this community is unlikely to maintain substantial standing water through the entire growing season. The size of this community likely varies from year to year depending on the amount of rainfall. During drought years, this community will likely be small or absent and largely replaced by *Persicaria*–Mixed Forb Temporarily Flooded Herbaceous Alliance. In heavy rainfall years, this community will be larger and impose on the herbaceous vegetation at the edge of the channel.

PERMANENT OPEN WATER — POW

This natural community was present the middle and downstream ends of the study area, below Judith Lane. It occurred both as relatively large, open pond-like areas and narrow channels located beneath the canopies of large deciduous trees (e.g., eastern cottonwood, sycamore, Siberian elm). In the study area, it is defined as somewhat shallow, open water that is both relatively permanent and relatively devoid of vegetation. The size of the community appears to be more constant than the previous open water community. No significant difference could be observed in community size following a rain event during the site visit. Only during larger storm events and spring run-off would the open water potentially overflow its bank and impinge on the forested alliances.

3.22 Rare Species

Notes on rare species occurrences were maintained during natural community and wetland mapping surveys of Dead Creek. One state threatened species of bird and one potentially rare grass was observed. Definitions of rarity and criteria for listing follow the Illinois Endangered Species Protection Board (2000).

- Illinois Endangered Species: Any species that is in danger of extinction as a breeding species in Illinois.

- Illinois Threatened Species: Any breeding species that is likely to become a state endangered species within the foreseeable future in Illinois.

- Criteria For State Listing: A species shall be included on the official list of endangered and threatened species when one or more of the following criteria exists: (1) Species included in the Federal list of Endangered or Threatened Species, (2) Species proposed for Federal Endangered or Threatened Species which occur in Illinois, (3) Species which formerly were widespread in Illinois but have been nearly extirpated from the State due to habitat destruction, collecting, or other pressures resulting from the development of Illinois, (4) Species which exhibit very restricted geographic ranges of which Illinois is a part, (5) Species which exhibit restricted habitats or low populations in Illinois, or (6) Species which are significant disjuncts in Illinois (i.e., the Illinois population is far removed from the rest of the species' range).

Brown Creeper (*Serthia americana*)

A small, brown-streaked bird related to nuthatches, the brown creeper occurs throughout most of the United States and southern Canada. As its name implies, it forages by moving closely over the stem and main branches of trees. Its diet is comprised largely of insects, though some seeds and nuts are eaten as well (Ehrlich *et al.* 1988). This bird commonly nests in conifer, mixed conifer-hardwood, or hydric forests. Special habitat requirements include standing dead trees with loose bark for feeding and trees greater than 25 cm in diameter for nesting (Thomas *et al.* 1979). This species was heard singing on 8 November 2000 from Area B (upstream of Judith Lane). This area possessed a few, very large diameter, standing dead trees. Brown creepers were also observed by previous site investigators (information supplied by Menzie-Cura & Associates). It is likely that brown creeper use of the Dead Creek study area is minor due to limited intact forest and the young age of most trees.

Early Wild-rye (*Elymus macregorii*)

This recently described species belongs to a group of taxonomically challenging grasses. Early wild-rye possesses a single spike of congested flowers tipped by long bristles. It occurs primarily in rich forests and floodplains in eastern United States and has been documented from five counties in Illinois (e.g., Fulton, Jersey, Knox, Peoria, Union) based on review of museum specimens performed by Campbell (in ed.). Because this species occurs in floodplain forests, a community that has largely been converted to agricultural land in Illinois, this species may be extirpated from portions of the state. Though this species is not formally listed by the Illinois Endangered Species Protection Board, early wild-rye appears to be rare in the state and information on its occurrence is being supplied in the event it becomes a state-tracked species. The only occurrence of this grass in the Dead Creek study area was from a *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest in Area C. It was located on the east bank of Dead Creek, upstream of Cahokia Street within wetland characterization plot C-4. The plants were limited to a small area (2 m^2) and were senescent with dispersing fruits at the time of observation. Poison ivy, trumpet-creeper, white snakeroot, rough-leaved dogwood, and black raspberry were associated species.

3.23 Invasive Plant Species

Invasive plants are generally considered to be species that can grow to densities that exclude other plants. Invasive species can be economically important when they interfere with agricultural species or can be ecologically important when they alter the character of native plant communities. Invasive species can be further classified into two categories: those that are native to an area and those that are not. Native invasive species are plants that are historically known to occur in an area prior to extensive human occupation that, due either to changing land use practices or introduction of foreign genotypes, have subsequently become problematic. The following discussion will be restricted to non-native invasive species.

The Dead Creek study area is occupied to a significant extent by non-native species. Though exotic herbaceous species are present, it is the introduced and escaped woody species found in the forested communities that are most prevalent. In the tree stratum, white mulberry, Siberian elm, paper mulberry, and tree-of-heaven are frequent throughout the study area and, in some cases, locally dominant. These trees alter the character of native riparian forests by replacing native plants. Common non-native lianas in the study area included trumpet-creeper, Japanese honeysuckle, and Chinese spindle-tree. Not only do these species produce very different fruits as compared to the native

river grape (seeds within a dehiscent fruit *versus* fleshy berries, respectively) but the non-native lianas were also frequently seen growing as a dense mat over the ground or other woody species. This growth form stagnates native plant regeneration. The growth form of the Amur honeysuckle, the common non-native shrub in the study area, likewise abrogates native plants by occupying space.

Because of the abundance of non-native plant species, good opportunity exists for habitat improvement should remediation activities occur. If floodplain sediments are removed, native species can be planted and non-native species controlled in the riparian communities of Dead Creek.

3.24 Wetland Characterization

Results of surveys and community plot sampling along the approximately 2.4 km of Dead Creek indicate the site has a highly modified wetland system that, for much of the season, appears to act more as a set of shallow ponds rather than a riverine system as its name would imply. The riparian communities portray classic symptoms of residential development, including narrow and fragmented forests, young canopy trees, limited vertical diversity in terrestrial habitats, bisection by numerous roads, disturbed drainage, and a high incidence of non-native species. Dead Creek, nonetheless, plays an important role in the local storm water flow, is a wildlife travel corridor, and is utilized by rare and uncommon plant and animal species.

The Dead Creek project area is subdivided into five areas referred to as Area B, Area C, Area D, Area E, and Area F[1]. The limits of each area and a general description of vegetation alliance and condition follow.

Area B

The upstream most section of the study area occurred between Queeny Avenue and Judith Lane. This stretch possessed a poorly defined stream channel with soft mud substrate (downstream) and sand and gravel substrate (upstream). Essentially no aquatic plants occurred in the open water areas indicating the water likely did not persist without rain events to restore it. The immediate eastern shoreline was generally a broad flat of exposed, saturated substrate dominated by herbaceous species (e.g., rough-fruited water-hemp, dock-leaved smartweed). This herbaceous community was bordered on the upland side by a relatively continuous band of early successional temporarily flooded forest. Most of the native trees expected to occur in this community, such as green ash and American elm, had been replaced by non-native species (e.g., white mulberry, tree-of-heaven, paper mulberry). The western shoreline had a more abrupt bank and was largely cleared of canopy species. Regeneration there was being stagnated by a dense and continuous covering of vines and lianas over the woody vegetation. This area was extensively used by sparrows and wrens (e.g., song sparrow, field sparrow, house sparrow, Eurasian tree sparrow, Carolina wren) due to the abundance of concealing

[1] For purposes of this report, Area F is defined as the stretch of Dead Creek between IL Route 3 and Water Street.

vegetation. In general, Area B was not closely bordered by homes but instead had several large fields and open areas abutting the riparian corridor.

Area C

This section of the study area, positioned between Judith Lane and Cahokia Street, is considerably different from Area B both in terms of hydrology and vegetation. Very little exposed substrate occurred in this area; rather water, vegetation, and leaf litter concealed the creek bottom. Herbaceous communities were much more dense and frequently grew out of shallow water, rather than open wet soil. The eastern shoreline consisted of a continuous strip of floodplain forest containing a mixture of native and non-native tree species. Though of young age and frequently with abundant non-native trees and lianas, this section possessed some of the better remaining examples of *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest. This community was found to harbor early wild-rye, a recently described species that appears to be rare in Illinois. The western shoreline of Area C was very different, due to close residential development. The forest was fragmented and open lawns bordered the creek in several areas. The water appeared to be more permanent as evidenced by the sparse aquatic vegetation present.

Area D

This portion of the study area, located between Cahokia Street and Jerome Lane, can be generally described as a linear pond that is split into two sections by Kinder Street. Both sections (above and below Kinder Street) are relatively similar. The channel is shallow (less than 100 cm deep), stagnant, and vegetated by several species of aquatics including floating primrose-willow, southern water-plantain, tall bur-head, and blunt spikesedge. A somewhat continuous band of rice cut-grass with smartweeds and other herbs (*Persicaria*–Mixed Forb Temporarily Flooded Herbaceous) occurred along the edge of the creek channel and in shallow water. On the stream banks was found the *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest alliance. This community varied in terms of both age and non-native species influence, and was cleared in a few areas due to residential lots.

Area E

This long section began below Jerome Lane and ended upstream of Route 3. It was consequently a variable section. The channel was relatively deep and open in the upstream portion of this area (in the vicinity of Club Lane) and frequently over 1 m in depth. Large portions of the upper channel are sparsely vegetated with free-floating herbs (e.g., minute duckweed, watermeal) and a few rooted aquatics near the edge. Further downstream, the creek became a narrow channel frequently shaded by large tree canopies. In these shaded sections of Dead Creek, open water in the channel was essentially devoid of aquatic vegetation. The *Persicaria*–Mixed Forb Temporarily Flooded Herbaceous Alliance was nearly absent throughout Area E, represented only by small patches in the shallow water edges of the channel. The forested community was

represented by two different alliances: *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest and *Populus deltoides* Temporarily Flooded Forest. The latter community was prevalent near the downstream section of Area E in the vicinity of the intersecting parking lot. Throughout this area, the forested communities were encroached on and fragmented by streets, residential areas, and parking lots.

Area F

For purpose of this report, the description of Area F is confined to the upstream section between Route 3 and Water Street. The channel of Dead Creek in this section is well defined with vertically cut banks. No aquatic vegetation was observed in the creek. Significant portions of the adjacent riparian forest was either entirely cleared of canopy trees or fragmented with isolated large trees. Construction of a gravel parking lot on the northwest side of the channel had eliminated adjacent forests. This portion of the study area was historically vegetated by a *Populus deltoides* Temporarily Flooded Forest, as evidenced by several, large, remaining eastern cottonwood trees. Clearing, ditching, and invasive species, however, appeared to have altered the site and the regenerating community had more in common with *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest. Non-native woody species were common and even dominant in the liana, sapling, and shrub strata. Two large diameter pipes emerged from the bank and crossed Dead Creek above the water surface. Current construction was occurring for culvert improvement near Water Street.

3.25 Soil Survey

Three different soils were reported to occur in the Dead Creek project area (Illinois Watershed Management Clearinghouse 2000). In the upstream portion of Area B, immediately south of Queeny Avenue, the landscape was considered Urban Land. This area was formally derived from alluvial soils and had since been modified by various earth moving and filling activity. The majority of Area B was Haynie Silt Loam. This soil is identified by its high composition of silt particles combined with lesser amounts of sand and clay. It is further characterized by 0–2 percent slope and occasionally flooded terrain. Beginning just upstream of Judith Lane (Area B) and occurring for the remainder of the length of the project area (to Route 3) were soils referred to as Shafton–Urban Land Complex. This soil, similar to Urban Land, is found in areas with a high degree of landscape modification. This soil is also described as having 0–2 percent slope and occasionally flooded terrain.

3.3 ANIMAL USE CHARACTERIZATION

Animal use of the Dead Creek study area was generally limited to species that do not require large tracts of pristine land and can tolerate some level of habitat modification and disturbance. These animals are mostly species that can utilize residential areas for foraging and/or shelter or are smaller vertebrates that have limited space requirements. The juxtaposition of forest, shrubland, and open water did provide for some landscape diversity. Additionally, the proximity of the site to the Mississippi River and presence of

wetlands provided feeding areas for migratory waterfowl and wading birds. The early age of most of the communities (due to disturbance), however, provided limited structural diversity.

Several species of bird were observed using Dead Creek and the adjacent riparian corridor for foraging and roosting during site visits from 2 and 8–11 November 2000. Many of the birds seen were those that frequent residential areas (e.g., American robin, northern cardinal, blue jay, northern mockingbird) and could use the project area for nesting. Carolina wrens, several species of sparrows, and Eurasian tree sparrows were noted utilizing the dense shrub and liana thickets north of Judith Lane in Area B. European starlings were seen roosting in large flocks in the larger trees along Dead Creek. Limited use of the open water sections by waterfowl and wading birds does occur. These open water areas of Dead Creek are likely also used during the breeding season for feeding by swallows, phoebes, and flycatchers. On two occasions, a great horned owl was seen in or near the study area. Bird species known or likely to occur in the Dead Creek study area are presented in Table 4. This table was created by field observations of bird sightings, notes on available habitat and condition, and gathering relevant range and life history information from National Geographic (1999), Korotev (1998), and Illinois Natural History Survey (2000).

Mammals using Dead Creek habitats were primarily rodents, small omnivores, and likely bats and insectivores (i.e., shrews). Eastern chipmunks and gray squirrels were seen frequently during the surveys. Raccoon tracks were found nearly everywhere the ground surface was conducive to track formation. The only large mammal documented in the study area was white-tailed deer. Numerous tracks were observed of this species. Mammal species known or likely to occur in the Dead Creek study area are presented in Table 4. This table was created by field observations of mammal sightings, notes on available habitat and condition, and gathering relevant range and life history information from Schwartz and Schwartz (1981) and Illinois Natural History Survey (2000).

Few amphibian and reptiles (collectively called herpetiles) were observed in the study area due to the time of survey. However, the stream channel and adjacent riparian forest provide habitat for a number of species that can occur in small, somewhat disturbed, water bodies. Animals that are ubiquitous in many wetland types in the United States, such as bullfrogs, northern cricket frogs, painted turtles, red-eared sliders, and common garter snakes, were expected to utilize Dead Creek for feeding and shelter. Herpetile species known or likely to occur in the Dead Creek study area are presented in Table 4. This table was created by field observations of amphibian and reptile sightings, notes on available habitat and condition, and gathering relevant range and life history information from Phillips *et al.* (1999), Johnson (2000), Conant and Collins (1991), and Illinois Natural History Survey (2000).

Though Illinois has a rich fish fauna, it was expected that few species would be found in the project area. Due to blocked drainages and elevated culverts, much of the upper Dead Creek functioned more as a series of linear, shallow ponds rather than a flowing stream course. Therefore, during much of the year, it would be difficult for fish to move through

the watershed to escape declining water levels or other stressful conditions (e.g., high water temperature, low dissolved oxygen, avian predators). Furthermore, Dead Creek generally possessed turbid water and had a soft bottom, eliminating species that require clear water and firm substrate. Blackstripe topminnows were seen in the upstream portion of Area E in approximately 50 cm of water. Other fish that could be found in the Dead Creek study area are listed in Table 4. This table was created by field observations of fish surveys, notes on available habitat and condition, and gathering relevant range and life history information from Fuller *et al.* (1999), McClane (1978), Missouri Department of Conservation (2000), Page and Burr (1991), and Illinois Natural History Survey (2000).

Invertebrate species use Dead Creek for feeding, reproduction, and larval habitat. Odonate larvae of both suborders Anisoptera and Zygoptera (dragonflies and damselflies, respectively) were observed. This order of insects has predaceous larvae. Their presence likely indicates that a prey base of smaller arthropods occurs in Dead Creek. Other predaceous invertebrates observed in Dead Creek were giant water bugs (Order Hemiptera). This species feeds on insects and tiny vertebrates (e.g., frog and salamander larvae). A relatively large crustacean (Order Amphipoda) was also observed south of Jerome Lane. This indicates fairly permanent standing water conditions for the upstream portion of Area E.

3.4 WETLAND FUNCTION–VALUE ASSESSMENT

The Illinois Department of Natural Resources (IDNR) currently does not recognize a formal procedure for completing wetland function-value assessments. Work is being completed by the United States Army Corps of Engineer's (USACE) St. Louis District office and IDNR that will generate wetland reference data in St. Clair County for use with the USACE's Hydrogeomorphic Assessment (HGM) technique. This technique utilizes wetland hydrogeomorphic classification, comparison to reference wetlands in the region, and set functional indices to determine wetland functional value. Because the necessary data for a comprehensive HGM assessment are not available at the time of writing, we have based this narrative assessment on HGM technique definitions and criteria in an attempt to facilitate agency review. Note that the HGM technique requires quantitative sampling of many wetland elements and processes. The objective of these initial field efforts was to collect baseline ecological data for potential use during restoration planning. Functions have been discussed in general terms, and are not intended to address each specific variable included in formal HGM analyses.

The HGM technique identifies seven distinct wetland types based on factors that influence how wetlands function. These factors include: (1) geomorphic setting, (2) water source, and (3) hydrodynamics. This technique also identifies regional wetland subclasses based on site-specific wetland characteristics. Based on this method, the upper approximately 2,400 m of the Dead Creek study area would be classified as a Depression (Open, Surface Water) Wetland. This determination is based on the fact that the system occurs in a series of topographic depressions with closed elevation contours that allow for the accumulation of surface water (Smith *et al.* 1995). In depression

systems, the direction of water movement normally is from the surrounding uplands to the center of the depression. These systems may have any combination of inlets and outlets. Given that the primary sources of water in this system include precipitation, overland flow, and interflow between basins, the HGM regional subclass "Open, Surface Water" would be assigned. It is likely that downstream portions of the Dead Creek system (i.e., unculverted stretches in Area F) would be classified as true riverine systems under this assessment method.

The following sections provide a narrative discussion of existing wetland functions in the upper portion of the Dead Creek study area from Area B to Area F. Functions discussed are based on the 15 wetland functions identified in the HGM methodology. Given the nature of this project, discussion has been limited to provide a general depiction of existing site conditions.

3.41 Dynamic Surface Water Storage

The portion of the Dead Creek study area encompassed by Areas B–F is functionally similar to a series of interconnected detention basins. Urbanization of the surrounding landscape has resulted in a high percentage of impervious surface including roads, parking areas, and buildings. This factor, combined with multiple culvert crossings and storm drain outlets, has altered the natural hydrology and flow regimes of this system. Each of the basins, as separated by road crossings, responded to inputs of overland runoff somewhat independently of each other. This was primarily due to culvert restrictions and culvert elevations that were, in several areas, above the channel bed elevation. Due to these factors, overland flows were detained in the creek bed for prolonged periods and downstream channel flows through the length of the system were limited to full pond conditions when surface water elevations exceeded culvert elevations. The eight basins included in this portion of the Dead Creek study area were able to detain large amounts of overland runoff, and desynchronize or gradually release flood flows that would have otherwise emptied directly to riverine portions of Dead Creek south of Route 3.

Dynamic surface water storage capacity refers to a wetland's ability to slow and partially detain overland flows from uplands, or overbank flows during flood events, prior to flows reaching the open channel or basin associated with the subject wetland. Dynamic surface water storage capacity was not considered to be an important function of the Dead Creek wetlands in this upper portion of the system. This is because Areas B–F were channelized and contained few functional floodplain wetlands. Rather than flows passing through floodplain wetland transition zones prior to entering a water body, overland flow drained directly into the channel or impounded water. Dense herbaceous vegetation persisted in the *Persicaria*-Mixed Forb

communities, and dense woody stems occurred throughout areas mapped as *Fraxinus–Ulmus* Temporarily Flooded Forest community. This vegetation may have contributed to site roughness and slow overland flow velocities. However, long-term surface water storage was likely a more important function provided by this portion of the study area.

3.42 Long-Term Surface Water Storage

Unlike the dynamic surface water storage function that relates to a wetlands ability to slow flowing water, long-term surface water storage relates to the wetlands ability to store water once overbank flow retreats into the channel or basin, and is present for durations in excess of seven days. Long-term surface water storage was a primary function of the upper stretch of Dead Creek given the multiple restricted outlets present. To some extent, each of the interconnected basins included in Areas B–F acted as detention ponds for overland runoff from adjacent developed areas. During site investigations, surface water depths in aquatic communities varied from 30–130 cm. Although investigations were limited to a single week in the field, aquatic communities observed were well established and supported aquatic plant and animal species typical of shallow pond ecosystems in the region. Several of the basins included relatively deep organic muck substrates indicative of long-term organic settling and decay.

As discussed above, culvert elevations that limited downstream flows were the primary factor allowing long-term ponding in this system. Continuous flows from Area B to riverine portions of Area F were likely limited to periods with high runoff when the individual basins were at full holding capacity and surface water elevations reached culvert heights throughout the length of the system. All of the areas investigated for the purposes of this characterization study showed signs of being able to expand surface water detention capacity beyond the apparent limits of developed aquatic community types. This ability to expand water detention was evidenced by identifiable debris lines, silt deposits, and ice damage to woody stems.

3.43 Energy Dissipation

Energy dissipation functioning relates to the physical expression of flow velocities (i.e., deposits of woody debris, gravel deposits, and channel scours) and how these occurrences contribute to further slowing channel velocities. Energy dissipation functioning in the study area was primarily attributable to standing surface water that in effect halted flow velocity in several basins and allowed for gradual release to downstream areas. A few portions of the study area demonstrated more of the traditional indicators of energy dissipation. These indicators were limited to areas less-frequently ponded that maintain some riverine characteristics. Area B included the most pronounced signs of energy

dissipation in the study area. These signs included scoured gravel deposits and braided channels within the mapped *Salix nigra* Temporarily Flooded Forest community; buildup of coarse woody debris, including large tree trunks, throughout the upper channel; and fine woody debris along channel edges. These elements contributed to channel surface roughness that in turn contributed to energy dissipation of flow velocities.

3.44 Subsurface Storage of Water

As periodic draw down of surface water and reduction in soil saturation occurs, water storage capacity in drained soil pores becomes available. This storage capacity provides available volume for storing surface flows that would otherwise directly increase channel or basin inundation. Subsurface storage functioning is largely dependent on soil porosity and rate of water level fluctuations. Wetland soils throughout the study area consisted of poorly and very poorly drained silt loams, most of which were permanently saturated or flooded. Subsurface storage of water was unlikely to be a significant function performed by study area wetlands given the low porosity of project area silt loams, and the apparent permanence of soil saturation throughout the project area. Upland soils present within the mapped *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest community type likely offered some subsurface storage capacity within the riparian corridor.

3.45 Moderation of Groundwater Flow or Discharge

This function refers to the ability of the receiving wetland to modify groundwater flow rates entering the wetland from up-gradient sources. Similar to a wetland's capacity to alter the rate of overland runoff, modification of groundwater flows enables a wetland to buffer downstream surface bodies from the effects of cumulative hydrologic inputs. The Dead Creek study area is located on a flat terrace within the Mississippi plain. This flat topography is not conducive to groundwater discharge or seep formation. No seeps were noted during our investigations, and the ability of the upper Dead Creek wetlands to perform this function is likely limited.

3.46 Nutrient Cycling

Analysis of the nutrient cycling function is intended to measure the ability of a wetland to maintain living biomass and detrital stocks. The balance achieved in a given wetland system to convert organic matter into primary productivity and in turn release nutrients back into the cycle as detritus is indicative of a wetlands ability to perform other functions. A proper assessment of this function should limit consideration of nutrient imports from outside of the wetland. The potential for the wetland to absorb nutrients in runoff is discussed below as part of the Removal of Imported Elements and Compounds function.

Seven distinct plant community types had been mapped in the project area. Each contributed to the uptake of nutrients for primary productivity and contributed to existing detrital stocks. Perhaps the greatest contribution of seasonal detritus came from the three

deciduous forested communities types: *Populus deltoides* Temporarily Flooded Forest, *Fraxinus pennsylvanica–Ulmus americana* Temporarily Flooded Forest, and *Salix nigra* Temporarily Flooded Forest. The measured average basal area for these stands in the study area was approximately 67 m/ha. Approximately 3.26 ha of deciduous forest communities were mapped in close association with the wetland study area. Detrital stocks, including leaf litter, downed woody debris, and standing snags, were noted throughout the length of the project area. Observed vigor and density of plant communities and few signs of eutrophication, or excess nutrients, indicated that net productivity and annual detritus turnover rates were in balance. Our ability to properly assess this function was limited by the lack of reference site data and quantitative measures of litterfall and net biomass production within the study area.

3.47 Removal of Imported Elements and Compounds

Removal of imported elements and compounds was a primary function performed by the project area wetlands. The urbanized landscape surrounding the study area, and the geographic position of the wetlands as headwaters to a riverine system enabled this portion of Dead Creek to intercept nutrients and contaminants from non-point overland runoff and point sources including storm drain outlets. The ability of the wetland basins to perform this function was further enhanced by long-term water detention capacity and the presence of both dense woody and herbaceous vegetation capable of removing elements through absorption into rhizomes and roots.

Additional variables contributing to the wetlands ability to trap nutrients included an abundance of surfaces available for microbial activity, sorptive properties of the study area soils, and deep organic sediment. Microbial activity removes or renders inactive many chemicals and compounds. Microbes are typically associated with complex surfaces such as leaf litter, humus, and plant surfaces. Aquatic vegetation in the *Potamageton–Cerataphyllum–Elodea* Permanently Flooded Herbaceous community throughout the study area provided substantial surface area for microbial activities. Fine textured soils such as the project area silts typically offer greater sorption capacities than more coarse soil types.

3.48 Retention of Particulates

Similar to the study area wetlands ability to remove dissolved substances in overland runoff, this system is able to slow and detain runoff waters and allow suspended particles to settle out of the water column. Restricted outlets in each of the basins prevent significant sediment flushing to downstream portions of Dead Creek. Over time, it is likely that the particulate matter accumulates in the lower portions of the basins and

becomes colonized by aquatic and emergent vegetation. The development of dense herbaceous communities within shallow portions of the basins likely augments retention functioning by increasing the roughness factor of the wetland and further slowing flow rates. The communities best able to support this function were the *Persicaria–* Mixed Forb Temporarily Flooded Herbaceous and *Potamageton–Cerataphyllum–Elodea* Permanently Flooded Herbaceous aquatic beds that occasionally covered the width of the basins and were therefore exposed to the largest percentage of flows. Surface runoff and storm drain outflows that emptied directly into open water portions of the study area wetlands were immediately slowed regardless of the presence of intercepting vegetation. In these situations, particulate matter was able to settle as a direct result of change in velocity.

3.49 Organic Carbon Export

Organic carbon export refers to the process through which dissolved and particulate organic carbon is exported from a wetland through leaching, flushing, and erosion. The ability of the study area wetlands to perform this function was limited to processes of leaching. It is likely that dissolved organic carbon (DOC) was leached from detritus and organic muck and transported via surface flows to downstream portions of the study area. Due to the relatively closed nature of this depression wetland system, much of the leached DOC was likely used by microbial processes within the basin.

3.410 Maintain Characteristic Plant Community

Seven vegetation alliances were mapped in the study area. Community determinations were based on Drake and Faber-Langondoen (1997). Because the portion of Dead Creek investigated for the purposes of this report was located in a residential area, the plant communities represented included some of the typical alliance characteristics, but were largely dominated by weedy and often non-native invasive species. Non-native invasive species common, and often dominant, throughout the study included:

tree-of-heaven
paper mulberry
trumpet-creeper
barnyard grass
Chinese spindle-tree
gill-over-the-ground
Japanese hops
reed fescue
Japanese honeysuckle
Amur honeysuckle
white mulberry
smartweed
lady's thumb
black locust
multiflora rose
curly dock
pigeon grass
Johnson grass
common chickweed
field hedge-parsley
Siberian elm
common mullein
common cocklebur

Determinations of plant invasiveness are based on Shackleford, Padley, and Schultes (1998) and on-site observations.

Few portions of the study area maintained community characteristics similar to the more mature bottomland hardwood stands in lower Area F. This was primarily due to the disturbance regime, dominance of non-native species, and 'edge' type community present along the Dead Creek corridor. A factor considered by the HGM method in the evaluation of this function is whether the project area community will, through succession, develop characteristics of typical reference wetland communities. The plant communities in the study area did not appear to be progressing toward a more typical bottomland community structure. Represented seedlings and saplings consisted, in part, of non-native species, including tree-of-heaven, paper mulberry, white mulberry, and Siberian elm.

The disturbed condition of plant communities throughout the study area limited the potential occurrences for rare, threatened or endangered species. Early wild-rye was documented in the *Fraxinus pennsylvanica-Ulmus americana* Temporarily Flooded Forest communities in Area C. This species is not currently listed by the Illinois Endangered Species Protection Board as rare, however, this is likely due to the recentness of this plant's description rather than its conservation biology. Information regarding this species occurrence has been included in Section 3.22.

3.411 Maintain Characteristic Detrital Biomass

This function relates to the presence of fine woody debris (wood <10cm in diameter) and coarse woody debris (wood >10cm in diameter) within the study area. Determinations are based on the production rates, accumulation, and dispersal of woody debris and other dead plant biomass as compared to reference wetland standards.

Four tree and shrub dominated community types occurred along the length of the study area. Only a few portions of the creek bank were without woody cover. Coarse woody debris, including standing snags, downed trunks, and branches, were noted within each basin other than the southernmost basin in Area E. Similarly, accumulations of fine woody debris were noted in drift lines along the wetland edge in most basins. Functions provided by woody debris varied with occurrence in each basin. Standing snags noted in Area B contained several cavities that were being utilized by Eurasian tree sparrows at the time of our investigation, and were likely used by several species during the breeding season. Downed trees and large branches in the Area B channel slowed flows and trapped additional debris carried in surface water. Silt and fine woody debris had accumulated behind several of the downed trees and branches in Area B. Elsewhere in the study area, coarse woody debris occurred in permanently flooded areas, acting as structure for aquatic habitat, while fine woody debris contributed to detritus available for nutrient recycling.

3.412 Maintain Spatial Structure of Habitat

The goal of assessing this function was to evaluate the structural and spatial complexity of the study area wetland plant community with focus on those elements that affect animal populations. The upper portion of Dead Creek assessed for the purposes of this report functioned as a riparian corridor, and in some respects a habitat island, which extended through a populated residential area. True wetland plant communities in the project area were structurally limited to herbaceous species and small patches of shrub and tree dominated communities. However, the adjacent temporarily flooded forest communities, although technically not entirely wetlands, maintained some structural diversity utilized by resident and migratory wildlife.

Dense shrub and liana growth occurred commonly along the banks of the study area, particularly in Area B. At the time of our investigations, eastern cottontail rabbits, northern bobwhite, and numerous perching birds, were utilizing these areas. Dense growth provided cover, fruit, and nesting opportunity, as evidenced by the abundance of songbird nests visible after leaf-off.

Uneven canopies (i.e., structurally diverse canopies) were present in the study area, but were sporadic and limited in size. Most of the tree stratum in the study area was too young or comprised of too few species to be very diverse. The patchiness of canopy cover contributed to the structural heterogeneity of the corridor. Species observed in areas with well-developed tree strata included roosting great horned owl, red-tailed hawk, woodpeckers, white-breasted nuthatch, and eastern gray squirrel. Trees that would be considered very mature by the HGM method were scattered along the length of the study area with greatest density occurring in the mapped *Populus deltoides* Temporarily Flooded Forest community in Area E. Similarly, several large snags were noted throughout the study area, but the occurrence of this structural feature did not represent a significant component of any community type mapped.

3.413 Maintain Interspersion and Connectivity

Proper evaluation of this function requires that potential for both aquatic and terrestrial organism movement be considered. Primary factors that dictate interspersion potential are surface water connections and the presence of continuous vegetative cover. Surface water connections that could facilitate inter-basin movements of aquatic invertebrates and vertebrates appeared limited to seasonal occurrences in some portions of the study area

and were relatively permanent in others. As discussed above, this was due to anthropogenic disturbances, primarily culvert crossings. Terrestrial connectivity was relatively continuous along the length of the study area given the dense shrub growth that lined most of the channel. This connectivity was fragmented by eight road crossings and a large parking lot. Overland access to areas outside of the Dead Creek corridor was not only limited by residential development, but also by the presence of fencing that would inhibit large mammal movements into or out of the riparian corridor.

3.414 Maintain Distribution and Abundance of Invertebrates

Due to the reconnaissance nature of these preliminary investigations, no attempts were made by Woodlot to comprehensively sample the existing invertebrate community. Proper analysis of this function as defined in the HGM method requires both terrestrial and benthic sampling to characterize invertebrate use and abundance within the project area. Potential for use can be assumed based on our site observations, macrophyte and emergent vegetation mapping efforts, and limited aquatic sampling. The HGM method identifies coarse particulate organic matter (CPOM) as a critical variable that can determine potential abundance of invertebrates in a given wetland system. The overland runoff detention capacity of basins and the presence of deciduous trees, shrubs, and lianas along most of the study area length likely added to the available CPOM required by invertebrates. Submersed macrophytes provided an important source of organic matter available to aquatic invertebrates. Floating primrose-willow was abundant in shallow, permanently flooded portions of the study area. The annual senescence of the emergent communities also contributed to available CPOM in the system.

3.415 Maintain Distribution and Abundance of Vertebrates

As discussed above, comprehensive assessments of vertebrate use in the study area has not been completed to date. Table 3 includes a list of species observed during vegetation alliance and wetland characterization work. This table also includes species likely to use the upper portion of Dead Creek (Areas A–F). Field observations for the purposes of this preliminary assessment were limited to five days in early November. During this time, 57 species of birds, and 5 species of mammals were observed without using formal sampling techniques. It appears that the riparian communities extending from Area B to Area F were well utilized by vertebrate species in the local area, and may have served as a localized travel corridor for species moving through this developed area.

Aside from the direct measures of abundance of fish, herpetiles, birds, and mammals, the HGM method also considers beaver use in the study area wetlands. Beaver herbivory was noted in several of the project area basins. No lodges, or dams were noted, but the increased downed coarse woody debris resulting from the beaver activity likely enhanced other wetland functions performed in the study area.

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APPENDIX 2

Specialized Seeding Specifications

SECTION 02933

SPECIALIZED SEEDING

PART 1 GENERAL

1.01 Description

This work shall consist of preparing the seed bed and placing the seed and other materials required in seeding operations on the shoulders, slopes, and any other designated areas of the project.

1.02 Definitions

A. Weeds: Inappropriate plants on this project which include - Jimsonweek, Quackgrass, Horsetail, Morning Glory, Mustard, Lambsquarter, Chickweek, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Perennial Sorrel, And Brome Grass.

1.03 Regulatory Requirements

A. Contractor shall submit maintenance requirements for continuing maintenance of established vegetated cover.

B. Contractor shall include maintenance instructions, cutting method and maximum grass height; types application frequency, and recommended coverage of fertilizer.

1.04 Delivery, Storage, And Handling

A. Products shall be delivered to site to support progress of work.

B. Products shall be stored and protected from deleterious conditions.

C. Grass seed mixture shall be delivered in sealed containers. Seed in damaged packaging is not acceptable.

1.05 Maintenance Period

A. Notwithstanding the Contractor's warranty, the Owner will pay the Contractor a lump sum price to maintain the Work in its accepted condition for two (2) growing seasons. The Maintenance Period shall start from the date of the Construction Manager's Final Acceptance. The Contractor's Maintenance Period Work shall include:

1. Establish and maintain successful revegetation of the cover in accordance with this specification.

B. The Contractor's Manager will inspect the grass growth at the end of the Maintenance Period. During the Maintenance Period, the Contractor shall mow the grass.

1.06 Submittals

A. Contractor shall submit certification that seed mixture conforms to this section and the *requirements of the State of Illinois.*

B. Contractor shall submit all material and workmanship warranties related to seeding.

PART 2 – MATERIALS AND EQUIPMENT

2.01 Seed Materials

The seed quantities indicated per hectare (acre) for Class 4A and 4B Seed Mixes shall be the amounts of pure, live seed (PLS) per hectare (acre) for each species listed. Seed which has actual PLS yield according to tests less than the intended yield, will have the specified quantity adjusted to meet the intended PLS yield.

Thirty days prior to the time of seeding, the Contractor shall provide for the approval of the Engineer, a written description of each of the seed mixes showing the percentage by mass (weight) of each of the kinds of seed. This description shall also include the following:

A. Name and location of the seed supplier,
B. Origin and date of harvest of each of the various kinds of seed,
C. A statement of the purity and germination of the seeds, and
D. The estimated number of seeds/kg (lb.) of each of the kinds of seed to be furnished.

2.02 Fertilizer and Agricultural Ground Limestone Application

No fertilizer nutrients or agricultural ground limestone shall be required for seeding or seedbed preparation on this project.

2.03 Equipment.

Equipment shall meet the requirements of the following.

A. Disk – The disk shall meet the approval of the Engineer and have sound unbroken blades, which have a minimum diameter of 375 mm (15 in.). The disk shall be weighted, if necessary, to obtain the require tillage depth if 75 mm (3in.).
B. Slope Harrow – Slope harrow shall consist of a rolling mass (weight) attached by heavy chain to a tractor. The chain shall be of suitable length, shall have picks welded to the links, and shall have a means of rotating the picks as the rolling mass (weight) is pulled in a direction parallel to the movement of the tractor.
C. Hydraulic Seeder – When hydraulic seeders are used, all seed and any inoculant required shall be applied in a single operation. Hydraulic seeding equipment shall include a pump rated and operated at no less than 375 L/min (100 gal/min) and no less than 690 kPa (100 psi) pressure. The tank shall have a mechanical agitator powerful enough to keep the seed and fertilizer in a uniform suspension in the water.
D. Rangeland Type Grass Drill and Interseeding Attachment – These seeders shall be designed specifically for the seeding of native prairie grasses and shall be approved by the Engineer prior to use. When seeding over existing turf, the rangeland type grass drill shall be equipped with a no-till interseeding attachment that is capable of cutting a slit in the soil free of leaves and debris, placing the seed in the slit, and compacting the seed into the soil of the slit.
E. Slit Seeder – These seeders shall be self-propelled or tractor drawn and shall be designed specifically for no-till interseeding of grass into existing turf.
F. Hand Held Fluffy and Small Seed Broadcaster – These seeders shall be designed specifically for extremely fluffy and small hard seeds. The seeder shall be able to accurately meter seed and shall have adequate controls and agitators to control the output of the small seeds.

PART 3 - EXECUTION

3.01 Seed Bed Preparation.

Seed bed preparation shall not be started until all stones, boulders, debris and similar material larger than 75 mm (3 in.) in diameter have been removed and all other requirements of Section 212 have been completed. The area to be seeded shall be worked to a minimum depth of 75-mm (3 in.) with a disk tiller or other equipment approved by the Engineer, reducing all soil particles to a size not larger than 50 mm (2 in.) in the largest dimension. The prepared surface shall be relatively free from weeds, clods, stones, roots, sticks, rivulets, gullies, crusting and caking. No seeds shall be sown until the seedbed has been approved by the Engineer.

3.02 Seeding Methods.

No seed shall be sown during high winds or when the ground is not in a proper condition for seeding, nor shall any seed be sown until the purity test has been completed for the seeds to be used, and shows that the seed meets the noxious weed seed requirements. The seeding dates for identified seed mixtures shall be from May 15 to June 30 and from October 15 to December 1.

All equipment shall be approved by the Engineer prior to being used. Prior to starting work, seeders and interseeders shall be calibrated and adjusted to sow seeds at the required seeding rate. Equipment shall be operated in a manner to ensure complete coverage of the entire area to be seeded or interseeded. The Engineer shall be notified 48 hours prior to beginning the seeding operations so that the Engineer may determine by trial runs that a calibration of the seeder will provide uniform distribution at the specified rate per hectare (acre).

When seed is applied with a hydraulic seeder, the rate of application shall be not less than 9500 L (1000 gal) of slurry per hectare (acre). This slurry shall contain the proper quantity of seed.

Any and all seed that is recommended by the supplier to be inoculated with bacteria shall be inoculated with the proper bacteria in the amounts and manner recommended by the manufacturer of the inoculant before sowing or being mixed with other seeds for sowing. The inoculant shall be furnished by the Contractor and shall be approved by the Engineer. The seed shall be sown as soon as possible after inoculation. Seed that has been standing more than 24 hours after inoculation shall be reinoculated before sowing. If any inoculated seed is to be applied by a hydraulic seeder, three times the normal amount of inoculant shall be used.

A. Seeding - Seeding shall be done using one or more of the following methods unless otherwise specified or directed by the Engineer:
   - Option 1 - Seeding may be sown with a rangeland type grass drill,
   - Option 2 - Seeding may be sown with a hydraulic seeder,
   - Option 3 - Seeding may be sown with a slit seeded that is specifically designed for native seed species, and
   - Option 4 - Where Options 1-3 are impractical, inaccessible or dangerous, seed may be sown "by hand" using a Hand Held Fluffy and Small Seed Broadcaster (such Seed Slinger™ Broadcaster or equal).

B. Interseeding - In any area shown to be seeded that has begun to establish an existing turf, such areas shall be interseeded. Prior to interseeding, all areas of existing turf to be interseeded except as listed below shall be mowed one or more times to a height of not more than 75 mm (3 in.). The equipment used shall be capable of completely severing all growth at the cutting height and distributing it evenly over the mowed area.

The cut material shall not be windrowed or left in a lumpy or bunched condition. Additional mowing may be required, as directed by the Engineer, on certain areas in order to disperse the mowed material and allow penetration of the seed. The Contractor will not be required to mow areas which may be designated as not mowable by the Engineer.

Debris encountered during the mowing and interseeding operations which hamper the operation or are visible from a roadway shall be removed and disposed of in a manner approved by the Engineer. Damage to the right of way and turf, such as ruts or wheel tracks more than 50 mm (2 in.) in depth, shall be repaired to the satisfaction of the Engineer prior to the time of interseeding.

All interseeding shall be accomplished using a rangeland type grass drill with an interseeding attachment, except:

1. When the use of a rangeland type grass drill is impracticable, inaccessible or dangerous, a slit seeder may be used to interseed the identified seed mixes,
2. Broadcasting or hydraulic seeding will be allowed as approved by the Engineer on steep slopes (1:3 (V:H) or steeper) or in inaccessible areas where use of the equipment specified is physically impossible. Sufficient water shall be applied to these areas to wash the seed down to the soil.

3.03 Seeding Mixtures.

The classes of seeding mixtures and combinations of mixtures will be designated in the plans. When an area is to be seeded with two or more seeding classes, those mixtures shall be applied separately on the designated area within a seven-day period. All seeding shall occur prior to placement of mulch cover.

Seeding Mixtures

4A Low Profile Native Grass

Scientific Name	*Common Name*	*Seeds kg/hectare (lb./acre)*
Andropogon scoparius	Little Blue Stem	5 (5)
Boutelova curtipendula	Side-Oats Grama	5 (5)
Elymus canadensis	Wild Rye	1 (1)
Sporobolus heterolepsis	Prairie Dropseed	0.5 (0.5)
Annual Ryegrass		30 (25)
Oats, Spring		30 (25)
Perennial Ryegrass		15 (15)

4B Wetland Grass and Sedge Mixture

Temporary Grasses

Scientific Name	*Common Name*	*Seeds kg/hectare (lb./acre)*
Annual Ryegrass		30 (25)
Oats, Spring		30 (25)

Wetland Grasses

Scientific Name	*Common Name*	*Species % By Weight*
Calamagrostis canadensis	Blue Joint Grass	12
Carex lacustris	Lake-Bank Sedge	06
Carex slipata	Awl-Fruited Sedge	06
Carex stricta	Tussock Sedge	06
Carex vulpinoidea	Fox Sedge	06

Eleocharis aciculoris	Needle Spike Rush	03
Eleocharis obtusa	Blunt Spike Rush	03
Glyceria striata	Fowl Manna Grass	14
Juncus effusus	Common Rush	06
Juncus tenuis	Slender Rush	06
Juncus torreyi	Torrey's Rush	06
Leersia oryzoides	Rice Cut Grass	10
Scirpus acutus	Hard-Stemmed Bulrush	03
Scirpus atrovirens	Dark Green Rush	03
Scirpus fluviatilis	River Bulrush	03
Scirpus validus	Softstem Bulrush	03
Spartina pectinata	Prairie Cord Grass	04

Variation in the seed quantities or varieties will be allowed in the event of a crop failure or other unforeseen conditions. The Contractor shall provide for the approval of the Engineer a written description of the changed mixture, the reasons for the change, and the name of the seed supplier.

3.04 Maintenance

Post Planting Maintenance of Dead Creek Revegetation Areas: The Contractor shall be responsible for post planting maintenance for two seasons following the planting and seeding all riparian areas.

A. Seeded areas:

1. Contractor shall high-mow seeded areas (that is, mow at a height above the height of the majority of the seeded native species) in order to control non-native and weedy plants. Early in the season the Contractor is to mow when weedy growth reaches 12" - 15". Mow to a height of 4" - 6". Later in season mow plants to a height of 12" - 15" when weedy growth reaches a height of 24" - 30". These mowing heights should be above desired native species but low enough to remove weedy, invasive growth that can shade natives and/or produce seed heads.
2. Based on assessment of first growing season by the Engineer, Contractor may be required to overseed in first fall/winter with seed mix to be specified by project professional.
3. Early in second season mow natives to height of 12" - 15" when weedy growth reaches 24" - 30".
4. Throughout maintenance period spot weed or use selective herbicide treatment to eliminate invasive vegetation as needed.
5. Burn native plantings after second growing season. Burn timing, fall or spring, to be determined by prairie horticulturalist.
6. Throughout maintenance period spot weed, remove by hand any problem weeds.

3.05 Warranty Period

A. The warranty period shall extend for a period of 1 year after acceptance of conditions by the Engineer.

B. Contractor shall immediately reseed areas which show bare spots at no additional cost to the Owner.

3.06 Method of Measurement.

All materials, equipment, and work to be performed under this specification shall be accomplished on a LUMP SUM basis.

3.07 Basis of Payment.

This work will be paid for on a LUMP SUM basis. The costs of all installation work will be paid upon the approval of the Engineer. The costs of all maintenance work shall be paid upon the acceptance of the work at the end of the Warranty Period.

END OF SECTION 02933

APPENDIX 3

Mulching Specifications

SECTION 02934

MULCHING

PART 1 GENERAL

1.01 Description.
This work shall consist of furnishing, transporting, and placing mulch or erosion control blanket over seeded areas.

PART 2 – MATERIALS AND EQUIPMENT

2.01 Materials.
Materials shall meet the requirements of the following

A. Mulch Material – Mulching material shall be dry mulch consisting of straw or hay of one or more of the following types: oat, rye, wheat, and prairie straw. Only undeteriorated mulch can be readily incorporated and shall be used.

B. Bonded Fiber Matrix – Bonded Fiber Matrix materials shall be a hydraulically applied bonded wood fiber matrix held together with a bonding agent. The materials should form a porous, flexible structure that is non-toxic and biodegradable. Matrix material to be "Soil Guard" as manufactured by Mat, Inc. or approved equivalent.

C. Excelsior Blanket/Standard Erosion Control Blanket/Knitted Straw Mat – These materials can only be placed in the project area where no significant "water shear" concern occurs. Materials should be an S75BN Blanket as manufactured by North American Green, or appropriate equivalent.

D. Heavy Duty Erosion Control Blanket – These materials can be placed in the project area where "water shear" concerns occur and must be approved by the manufacturer for anticipated water shear. Materials are anticipated to generally be an S150BN Blanket as manufactured by North American Green, or appropriate equivalent. Manufacturer shall review site conditions and identify the blanket which will provide the appropriate control and warranty.

E. Staples – Unless otherwise noted by erosion control blanket manufacturer, staples shall be made from No. 11 gage or heavier uncoated black carbon steel wire of sufficient stiffness for soil penetration. They shall be of the "T" or "U" configuration with pointed ends, 25 to 50 mm (1 to 2 in.) wide at the top and a minimum overall length of 150 mm (6 in.) from top to bottom. The staples for Heavy Duty Erosion Control Blankets shall be a specified here except that the legs shall be 200 mm (8 in.) or longer. The staples shall be packaged in cartons.

PART 3 - EXECUTION

3.01 Mulching Seeded Areas.
Within 24 hours from the time seeding has been performed, the seeded area shall be given a covering of mulch by one of the following methods as designated on the plans. On slopes steeper than 1:3 (V:H), mulch shall be applied the same day as seeded. Mulch shall be applied uniformly at the rate specified.

A. Method 1 - This method shall not be used on slopes steeper than or equal to 1:3(V:H). This method shall consist of hand or machine application of straw mulch at the rate of 4.5 metric ton/ha (2 ton/acre). The mulch shall be loose enough to permit air to circulate but compact enough to reduce erosion. If baled mulch material is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material.

B. Method 2 - Method 2 shall consist of placing and stabilizing straw at the rate of 4.5 metric ton/ha (2 ton/acre) over seeded areas. All requirements of Method 1 must be met plus the mulch shall be thoroughly stabilized. The Contractor has the option of any of the following procedures for stabilizing the straw:

   1. Procedure 1 shall consist of anchoring the straw into the soil by means of a mechanical stabilizer with dull blades or disks. These blades or disks shall be without camber, approximately 500 mm (20 in.) in diameter, notches spaced at approximately 200 mm (8 in.) intervals and equipped with scrapers. The stabilizer shall measure approximately 450 kg (1000 lb.), have a working width not exceeding 1.8 m (72 in.) and shall be equipped with a ballast compartment, so that when directed, mass (weight) can be increased.
   2. Procedure 2 shall consist of stabilizing the straw mulch using an approved mulch blower with bonded fiber matrix simultaneously with the straw as in Procedure 1, above, or with chemical mulch binder applied as an overspray according to Procedure 2. The bonded fiber matrix shall be approved by the Engineer and shall be applied at the rate and in the manner recommended by the supplier and approved by the Engineer.

C. Method 3 - This method shall not be used on slopes steeper than or equal to 1:3(V:H). This method shall consist of machine application of wood or paper fiber hydraulic mulch at the specified rate using an approved hydraulic seeder. The hydraulic mulch shall be applied as a slurry of 2.25 metric tons (2000 lb.) of mulch and not less than 19000 L (2000 gal) of water/hectare (acre). The hydraulic mulch slurry shall be agitated a minimum of five minutes before application. The seeding shall not be applied concurrently with this operation.

D. Method 4 – This method may be used in any slope condition. Use of manufactured erosion control blankets, including Excelsior Blanket, Standard Erosion Control Blanket, Knitted Straw Mat, and Heavy Duty Erosion Control Blanket shall meet manufacturer's recommendations.

Following the mulching operation, foot and vehicular traffic, or the movement of equipment over the mulched area shall be prohibited. At any location where mulching has been displaced by any Contractor's equipment or personnel, the seeding and mulch or other work damaged as a result of that displacement shall be repaired or replaced immediately at the Contractor's expense, in a manner satisfactory to the Engineer.

3.02 Erosion Control Blanket.

Erosion control blanket may be placed using excelsior blanket, standard erosion control blanket, knitted straw blanket, or heavy duty erosion control blanket. The blanket shall be placed within 24 hours after seeding operations have been completed on the areas specified.

Prior to placing the blanket, the areas to be covered shall be relatively free of rocks or clods over 40 mm (1 1/2 in.) in diameter, and sticks or other foreign material which will prevent the close contact of the blanket with the seed bed. If, as a result of rain, the prepared seed bed becomes crusted or eroded, or if eroded places, ruts or depressions exist for any reason, the Contractor shall to rework the soil until it is smooth and to reseed such areas which are reworked. After the area has been properly shaped, fertilized and seeded, the blanket shall be laid out flat, evenly and smoothly, without stretching the material.

The blankets shall be placed so that the netting is on the top and the fibers are in contact with the soil. For placement in ditches, the erosion control blanket shall be unrolled parallel to the centerline of the ditch so that there are no longitudinal seams within 600 mm (2 ft) of the bottom centerline of the ditch. In ditches, six staples shall be installed at uniform spacing across the upstream end of each roll. Placing and anchoring the blankets in ditches and on slopes shall be as follows:

A. Excelsior Blanket - For placement in ditches, the blankets shall be applied in the direction of the flow of the water and butted snugly against each other. The blankets shall be stapled in place, using six staples across the upstream end at the start of each roll and placing staples on 1.2 m (4 ft) centers along each side. A common row of staples shall be used along seams of adjoining blankets. Another roll of staples shall be used in the center of each roll and be alternately spaced between each side staple at 1.2 m (4 ft) centers. All seams shall overlap at least 50 mm (2 in.). On slopes, the blankets shall be applied either horizontally or vertically to the contour and stapled in place similar to ditch application except that the space interval shall be 1.8 m (6 ft).

B. Knitted Straw Blanket - The rolls shall be butted snugly together and stapled in place. The staples shall be driven through the blanket vertically into the ground for the full length. Each staple shall anchor the plastic mesh. The staples shall be spaced in a diamond pattern with the longer dimension in the direction of the slope and the shorter dimension across the slope. The longer dimension shall be a maximum of 1.8 m (6 ft) and the shorter dimension shall be a maximum of 900 mm (3 ft). A common row of staples may be used on adjoining rolls. For placement on slopes, knitted straw blanket shall be unrolled in the direction of the slope and shall extend a minimum of 900 mm (3 ft) over the crest of the slope. On slope applications, six staples shall be installed on uniform spacing across the uphill end of each roll. The downhill ends of the lowermost rolls across the slope also shall be anchored with six staples, placed on uniform spacing.

C. Heavy Duty Erosion Control Blanket - This blanket shall be installed according to Section 3.01, except that the following stapling pattern shall be used: place six staples across the start of each roll and continue this pattern along the roll at 600 mm (2 ft) intervals. Adjacent blankets shall overlap 50 mm (2 in.), and the edge staples shall penetrate both blankets. The center two staples shall be alternately spaced between each side staple. Staples shall be as specified in 2.01 except that the legs shall be 200 mm (8 in.) or longer.

3.03 Method of Measurement.

All materials, equipment, and work to be performed under this specification shall be accomplished on a LUMP SUM basis.

3.04 Basis of Payment.

This work will be paid for on a LUMP SUM basis.

END OF SECTION 02934